



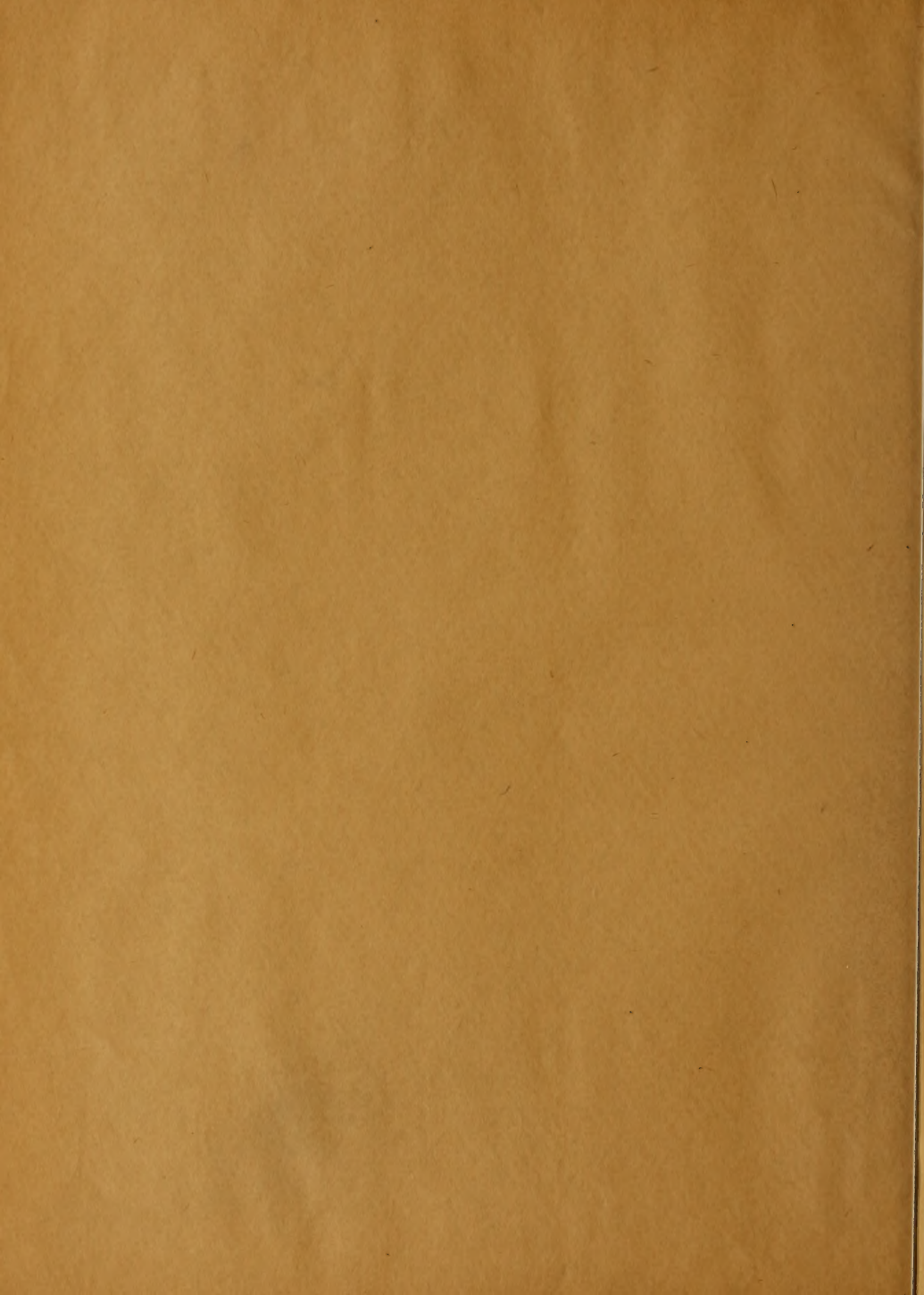
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Further Observations and Clinical Findings in Roentgenography of the Chest

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AT the last annual meeting of this Society, I presented for your consideration certain observations which I had made concerning chest roentgenography. In this paper, I wish to briefly describe certain additional points in this technique, and the results of their application. I shall confine my remarks to the early pulmonary disease.

Let us consider again the time factor—that all-important factor which we have all been striving to master. On fluoroscopic examination we observe that the patient is able to suspend the movement of the diaphragm, the ribs and muscular structure at will, but the heart continues gayly on. On closer inspection, we see that with each systole the lung adjacent to the heart moves toward the heart area. On diastole the same lung structure moves away from the heart. We can also see that this movement is plainly transmitted for two or three inches in a wide area around the heart, and less plainly for a still greater distance. Especially is this true where there is or has been disease in this region. This systole and diastole consumes at the most not over one-half second each.

Also, we see that a bronchus near the heart moves in a path whose width equals from one and one-fourth to two times the width of the bronchus. This movement is completed in the same time as the heart completes its cycle. In other words, in one-half second the heart moves in systole and the bronchus moves one-half its width towards the heart. A picture taken in one-fourth second would portray this

bronchus moving one-fourth its width; one-eighth second exposure would portray the bronchus moving one-eighth its width. These figures are approximately correct, as the heart nearly always beats faster than one cycle per second, while the bronchus may move a less distance.

Studying the chest still further under the screen, we can see minute tubercules, and other localized areas of disease traversing similar paths to the bronchus. The movement from the auricle is rather imperceptible, but that from the aorta and great vessels (arterial pulse) is quite evident, and opposite in time to the ventricle movement. It thus produces a rocking motion of the lung. Turning to the peripheral lung fields, we see no movement, but on post mortem, we find a jelly-like mass here which must respond to vibration.

This is all involuntary movement. To this must be added the voluntary movement of our dyspneic patients and the children. In fact, a stethoscope placed over the trachea will show a slow escape of air, even in those patients whose respiration seems to have been suspended. Also the vibration of our patients and apparatus is at times considerable.

If we were to photograph a moving object with a camera, we must do so with a lens so fast that all motion is stopped. In a like manner in chest roentgenography, we see from the calculations that our time must be one-tenth second or less. This exposure I find to be very practical at the present time, and with the proper balancing of voltage and milliamperes to lose none of the contrast and richness.

The tube is another very important factor with two points of interest, stability and the focal spot. Needless to say, in an exposure of so short a time we must have a tube stable enough to give us the current desired at the proper time. The focal spot of this tube is the lens of our camera. The size of this spot indicates to us its ability to focus the rays upon a certain density.

If we have a very fine point of focus, we will find that an object five inches from the plate is sharply outlined when the anode is twenty-eight inches from the plate. A broad focus tube would need to be nearly forty inches from the plate to sharply outline this same object. This explains why some roentgenologists have their tube from thirty-six to sixty inches from the plate and obtain better results. But this greater distance means considerable loss in power and quality of the rays. This in turn calls for a longer exposure, more current and a greater strain upon the tube. We then have a vicious circle. It was to overcome this vicious circle and reach some compromise that I began the measurements of chests. Of one hundred sixty-five chest cases coming into the office in which we measured the anterior posterior diameter, we found this diameter to range from five and one-fourth to eleven and one-half inches. The greatest number of cases was twenty-one at eight inches. That portion of the anterior posterior diameter from the posterior surface of the lung through to the anterior surface of the chest wall we called the focal depth of the lung. This focal depth of a patient measuring eight inches in

the anterior posterior diameter averaged seven inches. To this must be added another inch for the distance of the patient from the film. In other words, the problem is to bring a lung measuring eight inches at its furthest point from the film into sharp relief on the finished film. But the sharpest focus tube which I have been able to purchase in the market will only focus an object five or six inches from the film at twenty-eight to thirty inches. Then there is still two inches of the posterior lung out of focus, and in all cases with a still greater anterior posterior diameter there is still a greater amount of the lung out of focus. The focusing rather than so much tissue to penetrate, seems to explain why we get blurring and an indistinct film in thick people. We have an aid in stereoscopic plates whereby we can see the anterior and posterior parts of the lung.

With these points in mind, we can work out our technique to cover the entire lung field. To increase the distance too far at the expense of our time factor is inadvisable, and it seems best at present to compromise. With our very fine focus tubes we can cover the majority of our cases at twenty-nine to thirty inches, and then in our large chests take them on their backs for study of the posterior lung fields. This enables us to work at one-tenth second or less with no unusual wear upon the tube.

In the application of these observations let us study our finished film and see our results. The heart and its vessels we find in sharp outline so that we may observe any gross lesion. The hilus and portions of the mediastinum show any fibrous or glandular change without confluence of shadows. Study can then be made of any infiltration of hilus glands and spread of infection to the adjacent lung.

The bronchi passing out from the hilus are seen with sufficient clearness so that we may make a study of the bronchial walls and adjacent lymphatics and vessels. In the peri-bronchial thickening of tuberculosis the bronchi show that sharp fibrous outline with beading so characteristic of that disease. The sharpness of outline often indicates the degree of chronicity. In chronic bronchitis

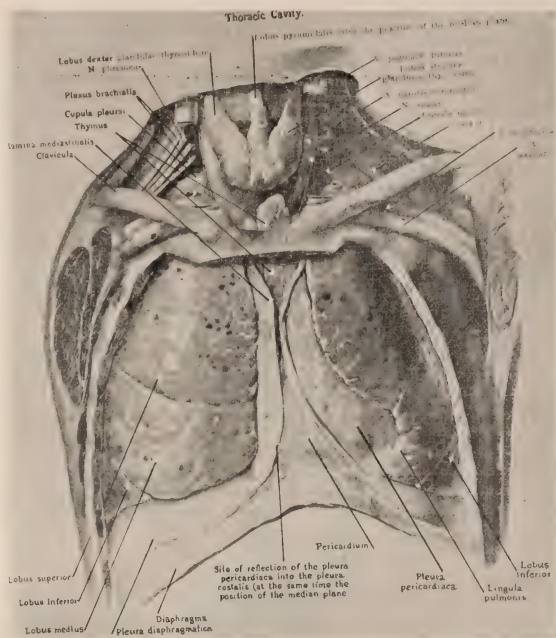


Figure I.—Reproduction from Spalteholz *Anatomy* showing close relationship of the thoracic viscera.

the bronchial walls are thickened, while in the purulent form, they are not only thickened, but have hazy, fuzzy outlines, indicating congestion and involvement of adjacent structures. This is also

true of the bronchiectatic form, with the addition of localized pockets and dilatations in the bronchial lumina. This enables us to diagnose our bronchiectatic cases quite early, perhaps in the

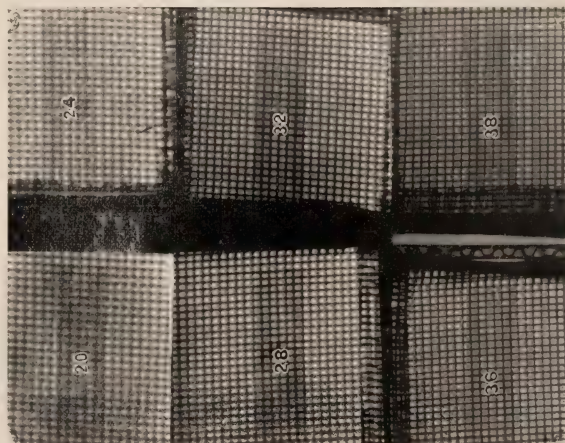


Figure II.—Target test with wire screen five inches from plate and the anode of tube at distance indicated. It will be observed with the anode twenty inches from the plate the image is completely blurred, while with the anode thirty-eight inches from plate the image is well defined.

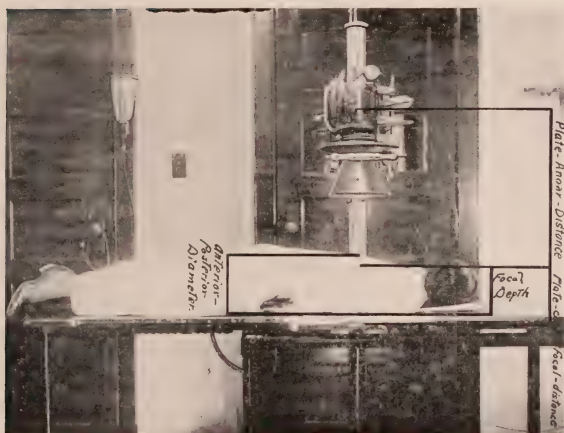


Figure III.—Photograph of table, patient, and tube illustrating the principles involved in the plate-anode-distance.

future before the dilatation has actually occurred. Still we have many who insist that the roentgenogram has very little value in bronchiectasis and only shows hazy, indefinite bronchial shadows!

Tracing the bronchi towards the periphery we find that we have a very clear view of them down to the small bronchioles in even the normal lung. It is then possible to study any change from the normal in these small bronchioles and in the secondary lobules. The first change that we observe is a broadening of these shadows with perhaps some beading scattered through its mesh and this lymphatic engorgement which has been found by Miller and others to be along the bronchi and septa about the lobules may extend to the hilum.

In the next stage the small beading becomes more and more confluent until we have a small patch indicating air cell congestion, and if this patch becomes sufficiently large it will give signs which may be detected by the stetho-

scope. This air cell congestion is pathognomonic of activity and is to the roentgenologist the same as the rale to the internist. The earlier changes are not infallible. This description is characteristic of some chronic infection, notably tuberculosis, rather than some very acute process where a whole lobe is overwhelmed in a few hours. In an advanced case of tuberculosis, we can find similar areas where the process is just making its beginning.

To make the statement that there is interweaving of the terminal bronchi is insufficient, as we may have this as an extension from the hilum in bronchiectasis. In cardiac diseases, dust and chemical inhalation, chronic pneumonitis and tumorous growths, we have similar processes to differentiate. Here, however, the general picture will usually give the key to the diagnosis.

Our final consideration is the value, if any, of this minute study of the lung structure to the internist. I have asked Doctor

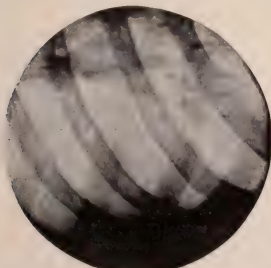


Figure IV.—Radiograph made of lung, post-mortem, inflated to full capacity and not injected. This specimen was obtained from a suicide who had cut his throat, so there was no post-mortem stasis of blood in lung tissue. Observe the minute ramification of bronchi and the general parenchymal structure.

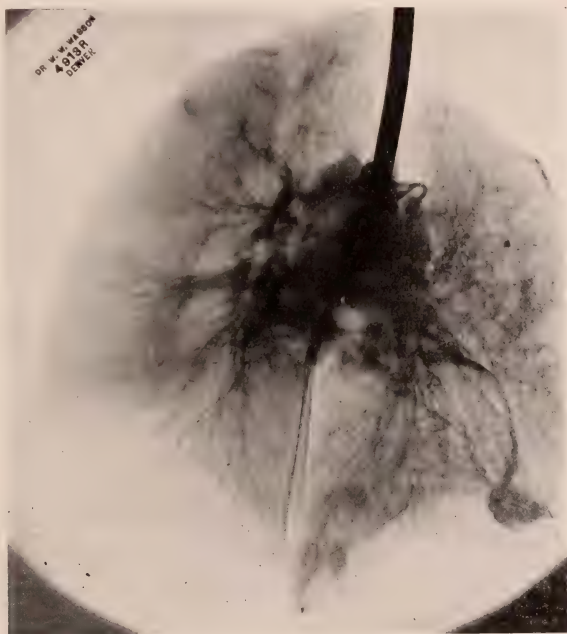


Figure V.—Same as figure IV in which barium was traced on the connective tissue marking off the lung lobules on the pleura. At A. These lobules are further from the plate and while shown are not clearly outlined. At P. These same areas are well defined.

James J. Waring of Denver, who is ably informed in these matters, to give you a summary of the internist's viewpoint. He states as follows:

Barjon says, "If the radiologist ought to be a physician, it would be well also for the physician to be, in a less degree, a radiologist." This is particularly true if the physician be a specialist on diseases of the chest.

A few years ago, radiography of the lungs was experimental. Today it is fundamental to a complete examination of the chest; and indeed, in doubtful cases it is the wise physician who refuses an opinion without the additional evidence of a study of stereoscopic plates. If it is important that the physician should have long training and experience in the technique of physical examination, that is, in the technique of inspection, palpation, percussion and auscultation, it is more than equally necessary that the roentgenologist should have special training in the particular technique of radiography of the same portion of the body.

A tolerably good picture of the lungs in suspected pulmonary disease is worth no more than a tolerably good physical examination. The greatest field of usefulness of the x-ray in the diagnosis of pleuro-pulmonary affections lies in the differentiations of borderline conditions, among which stands preeminently tuberculosis. Early pathology may be recognized with certainty, early etiology with vastly less certainty. The greatest value of the revelation of early pathology by the x-ray consists in this, that it frequently confirms and establishes the tentative clinical diagnosis.

In even the best plates interpretation is difficult, sometimes impossible. Positive statements as to the origin of certain shadows may be unwise, and frequently may lead astray the roentgenologist as well as the clinician. Poor plates, lacking definition, not large enough to include the whole chest, not made in the briefest possible time, are worse than useless. From them will be drawn false conclusions.

The writer has in mind a case

thorax that was radiographed at his request, and a negative report returned. Examination of the plate showed that it was not large enough to include the very area under suspicion. Another plate of the suspected area clearly revealed the partial pneumothorax.

Again, in a case of encapsulated empyema, where the diagnosis was confirmed by the x-ray, and the pus evacuated, the patient's septic type of temperature continued. A repeated x-ray examination was interpreted by the radiographer not to disclose any other pocket. Yet pus was surely indicated by the febrile movement. Physical examination suggested the only possible location of fluid as coinciding with the normal splenic dullness at the left base in the axillary line. Pus was found at this point.

This illustrates the great need for the physician to be able to interpret his own plates. It teaches him not to follow blindly his colleagues' opinion nor to ignore utterly important clinical evidence.

The writer does not wish to be understood to say that the physician should rely solely on his own judgment or set up his interpretation of a plate above that of his colleague, the radiographer. There are two extremes of opinion. On the one hand, is the clinician who refuses point blank to give the x-ray man any clinical data whatsoever. "Forsooth," says he, "if I tell him the history, he will make the diagnosis from it and not from the plate." His position is as unsound as that of the clinician who is blind to the secrets of the radiograph and accepts as gospel the roentgenologist's opinion. Between those two extremes lies a middle ground upon which the physician and x-ray man should get together. There is unquestionably a group of cases in which the wise radiologist should—and does—speak thus conservatively, "Here is pathology, what is the clinical history?" Similarly the laboratory man is compelled to report on a Wasserman test, "Here is such and such percentage hemolysis, and what is the clinical history?"



Figure VI.—Compare this lung field with its small ramification of bronchi and parenchyma structure with similar areas in Figure IV.

A good plate is never in error. Its radiological secrets are there if they can be divined. They may be read by one man and not by another, nor yet by either. The clinician, the roentgenologist and the chest radiograph—the former's interpretation, the latter's interpretation, and finally, the facts—do they coincide?

The situation is comparable to a guide and a tender-foot in the mountains. The guide, with eyes and brain trained from long experience to the recognition of shadows and colors, distinguishes a deer from the environment when a tender-foot can not see it.

Admitted that close co-operation between the clinician and the x-ray man is most desirable in the expert study of diseases of the chest, in what particular type of case is such co-operation most profitable? What is the

percentage value of the x-ray in the general diagnosis of pulmonary diseases when compared with the clinical history, the physical examination and the laboratory findings? It is evident that such relative evaluation is well nigh impossible in general. A sputum positive for tubercle bacilli is at once, as a laboratory finding, worth one hundred per cent.

On the other hand, there is a group with negative sputum findings where the x-ray is vitally important, perhaps determines the diagnosis. In all cases, the x-ray is important if one includes in the word "diagnosis" a comprehensive report indicating the location of the tuberculous process, the location of areas of consolidation, the presence or absence of enlarged glands, the condition of the bronchi, presence or absence.

location and size of cavities, the presence of effusion, pneumothorax, et cetera.

In conclusion, from the clinical standpoint, from long close and careful co-operation with the most skilled radiographers, the writer has found the x-ray most helpful in the following groups of cases:

- 1—In the diagnosis of frank pulmonary disease to assist in the determination of its tuberculous or non tuberculous nature.
- 2—In the diagnosis of suspended pulmonary disease.
- 3—In the presence of manifest tuberculous disease to determine its location and distribution, and to assist in arriving at a prognosis, and as a general guide to handling of the case.
- 4—In the diagnosis of certain pulmonary complications, for example, pneumothorax, effusion, etc.
- 5—As a routine preliminary to artificial pneumothorax, and in the subsequent care of these cases.

Homogeneous Radiation of the Chest

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EVERY ONE who seriously treats cancer of the breast sees cases of recurrent or metastatic carcinoma in which, under x-ray treatment, apparently complete retrogression of the growths takes place and the patient greatly improves in health and strength, but finally dies from a recurrence or an extension of the disease into the mediastinum or the lung.

We know that in these particular patients, at least, a sufficient amount of x-ray causes the disappearance of the superficial growths or at least holds them

in check. It is probably also proper to assume that if the mediastinal glands and all parts of the lung were to receive approximately the same dose as the growths immediately underneath the skin, the effect on them would be the same and the progress of the disease as completely stayed in the deep structures as at the surface.

Admitting the correctness of this assumption, and bearing in mind the complexity of the lymphatic drainage of the breast, and the danger of neglecting one chain of glands while concen-

trating on another, it is evident that uniform radiation of the whole chest is desirable and even essential to the best results. Our problem is, then, to determine what combination of anode-skin distance, size of fields, number of fields, voltage, and filters will produce the most nearly homogeneous radiation, or, more simply expressed, what set of factors will give the least surface depth dose ratio.

To obtain the average surface-depth distance and the skin area of the chest, about one hundred women were measured by bending a lead wire over the shoulder and around the thorax below the

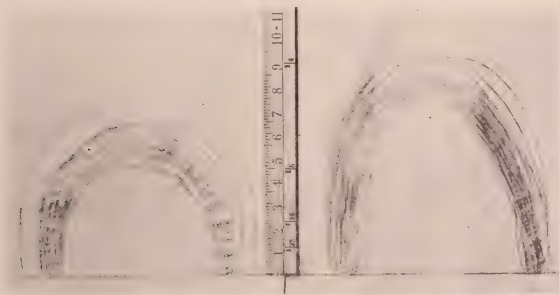


Figure I.—Photograph of composite transverse and vertical sections of one hundred chests.

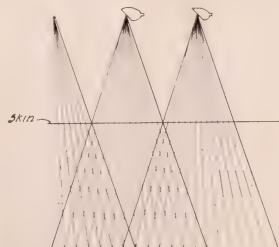


Figure II.—Diagram showing over-exposed erect pyramids of tissue alternating with under-exposed inverted pyramids of tissue when small fields and a short anode-skin distance are used.

nipple line. Composite vertical and transverse sections were constructed from these measurements, (Fig. 1). The average surface depth distance was found to be four centimeters. A paraffin phantom was then constructed, which, when tested by photographic and ionometric measurements, was shown to have approximately the same absorption value as the living chest.

The size of the fields and the anode-skin distance must be considered together. There is no doubt that by radiating the chest through many small fields it is possible to administer a full depth dose. In practice, however, the use of many fields has the following disadvantages:

- 1.—The center of each field is the base of a pyramid of tissue which receives a progressively smaller percentage of the skin dose as depth increases, (Fig. 2).
- 2.—The corner of a field, where it joins the three adjacent fields, is the apex of a pyramid which a short distance under the skin receives almost four times the skin dose, (Fig. 2).
- 3.—There is danger of overlapping areas and of leaving untreated strips of surface between areas.

Size of Area	Seconds to Discharge 15 mls. of Surface	Seconds to Discharge 15 mls. of Depth	Quotient
2 CM. Square	17.5	70	4
15 CM. Square	12.5	36	2.9
2 CM. Square	17.5	70	4
15 CM. Square	12.5	36	3

Figure III.—Chart showing surface-depth ratios with small and large areas over the paraffin phantom and over 6 cm. of water.

100 K. V. Filter of 0.5 mm. copper and 1.0 mm. aluminum. Current 2 M.A. Anode-surface distance—40 cm. Anode-depth distance—50 cm.

If, for example, instead of treating four areas each four centimeters square, ten minutes apiece at an anode skin distance of eight centimeters, the tube were removed to a distance of sixteen centimeters and the four areas treated for forty minutes, it is evident that the skin dose will be the same. The total amount of radiation received by the body will also be the same. It will, however, be more evenly distributed, and there will be a substantial drop in the surface depth ratio, due to the lessened diver-

gence of the rays at the greater distance. The data of Friedrich and Kroenig, as published by Schmitz, shows that there is a further increase in the depth dose when large fields are used, probably because of increased secondary radiation. My own observations corroborate their findings, as shown in Fig. 3.

POSITION OF IONIZATION CHAMBER	SECONDS TO DISCHARGE 15 ml. H ₂ O			
Center of Field	68	68	7	7
Left Edge	7	7	74	7
Right Edge	7	7	72	7
Edge of Anode Side	78	78	74	74
Edge on Cathode Side	72	68	74	72

Figure IV.—Chart showing nearly equal intensity of all parts of the field.
75 K.V., no filter, 12 inch distance.

Measurements with the ionization chamber in different parts of the entire field, when the ordinary type of tube stand is used, show the intensity to be practically the same throughout (Fig. 4).

We may conclude, then, that the anode-skin distance should be just great enough to permit the entire surface to be treated at one time. Trial shows this distance to be sixteen centimeters, which will evenly radiate a circle ten centimeters in diameter.

The shape of the half chest, roughly, a quarter of a sphere, lends itself admirably to attack in four directions, antero-posteriorly, postero-anteriorly, laterally, and vertically. To radiate the whole chest it is only necessary to expose two additional areas on the opposite side, one vertically, and one laterally.

Granting that exposure of the half chest in four planes from an anode skin distance of sixteen

centimeters, utilizing the whole field of effective radiation, tends towards uniformity of distribution of the rays without waste of tissue and energy, it is apparent that our problem has become a much simpler one. We have only to determine, if possible, the combination of voltage and filters that will deliver at least one-fourth of the surface dose to the center of the chest, so that the sum of the four depth doses will equal one skin unit.

In order that relative measurements of intensities might be made rapidly and accurately, we constructed a crude electroscope, equipped with a reading microscope for observing the rate of fall of the gold leaf, and connected to an ionization chamber by an enameled copper wire, which was insulated and supported by paraffin and sulphur, and enclosed in flexible metal tubing, (Fig. 4).

A series of measurements with the ionization chamber at the surface and at a depth of four centimeters in the phantom showed a definite drop in the ratio of the intensities at these two points whenever the voltage was raised, (Fig. 6). At the limit of the apparatus, one hundred kilovolts measured with a sphere gap, the ratio was about eight to one. Abandoning the lower voltages as being less efficient, we made a second series of measurements at one hundred kilovolts, using gradually increasing thicknesses of aluminum as filters. The addition of each layer of aluminum was followed by a further drop in the surface-depth ratio, until, with a filter of ten millimeters of aluminum, the

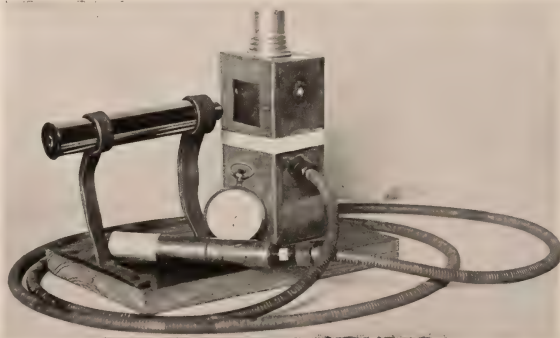


Figure V.—Photograph of measuring apparatus.

necessary ratio of four to one was obtained, (Fig. 7).

The foregoing measurements were all made through a diaphragm two centimeters square in order to eliminate secondary radiation. When the exposures were made over an area six centimeters square, the ratio was reduced to three to one, (Fig. 3).

When one-half millimeter of copper backed with a millimeter of aluminum was used in place of the filter of ten millimeters of aluminum, there was no material difference in the readings, (Fig. 3).

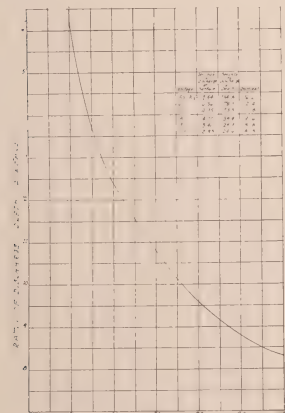


Figure VI.

The rate of discharge of the electroscopie with the ionization chamber at a depth of four centimeters in the paraffin phantom, was the same as when it was placed under two and one-half centimeters of water, (Fig. 3). This corresponds closely enough to the thickness of the chest

walls of the average sized woman of cancer age.

The conclusions to be drawn from this series of observations are:

- 1—The half chest should be treated from four directions, using the whole field of effective radiation.
- 2—The anode-skin distance should be sixteen centimeters.
- 3—At least one hundred kilovolts should be used.

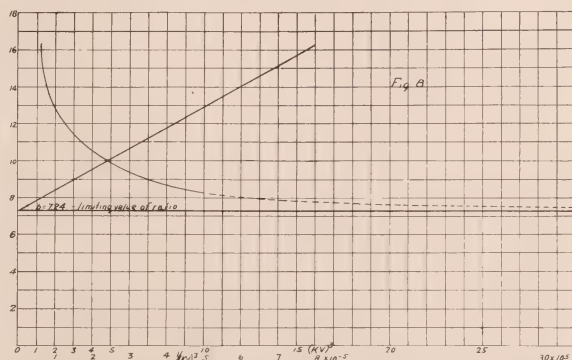


Figure VIII.—The solid portion of the curves in Figures VIII and IX was plotted from the data, the dotted portion was computed. In the case of varying voltage with no filter, the curved line was obtained by plotting the ratio against the cube of the voltage, and the straight line by plotting it against the reciprocal of the cube of the voltage. In Figure IX the curved line was obtained by plotting the ratio against the thickness of the filter and the straight line by plotting it against the reciprocal of the thickness, minus a constant, which was computed from the equation.

DATA FOR CURVES IN FIG. 8

Seconds
to Dis-
charge
at

Surface	Depth	Ratio	kv (kv) ³	1/(kv) ³
9.44	134.8	16.2	50	125
6.36	78.5	12.4	60	216
4.95	52.3	10.8	70	343
4.00	38.4	9.6	80	512
3.40	29.9	8.8	90	729
2.93	24.4	8.3	100	1000

Computed	7.8	120	1728
	7.6	140	2744
	7.25	200	8000

Distance to Depth—50 cm.

Distance Surface—40 cm.

No filter.

Y—Ratio.

X—KV

(y-b) x³ = K —Equation of Curve

K = 1,327,000

b = 7.24 —Minimum Value of Ratio.

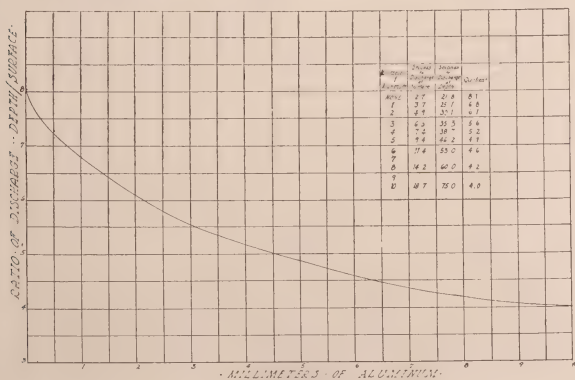
and to Mr. Edward M. Smith, whose assistance in taking the readings and arranging the data was invaluable. The curves and data for Fig. 8 and Fig. 9 were furnished by Mr. Ernest E. Smith.

Discussion

DR. W. D. COOLIDGE, Schenectady, N. Y.: Dr. Erskine has referred to the spark-gap tables given in the Standardization Rules of the American Institute of Electrical Engineers, and, in accordance with these tables, has expressed his results in effective volts.

As the major part of the x-ray output of a tube takes place when the voltage is near the maximum, it seems better to give x-ray data in terms of maximum voltage. The transposition is effected by multiplying the effective volts by 1.41.

DR. HENRY SCHMITZ, Chicago: The paper of Dr. Erskine shows ex-



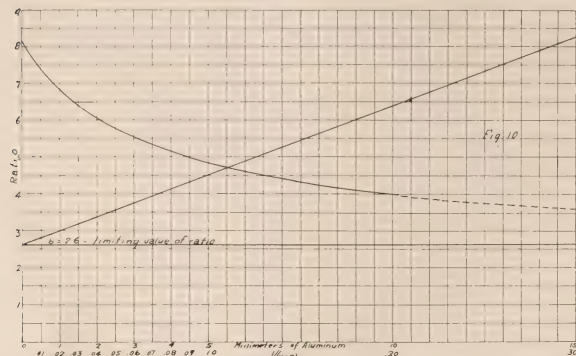
actly what can be done with the application of physical measurement in x-ray therapy, by making such an instrument, which any one can do who knows about the relative intensity of

radiation. That is exactly what we want and that is what is claimed by Froelich for his instrument. It also shows us what amount of voltage we have to use and what amount of filter

and distance in order to have as favorable a proportion between the surface and the depth dose as we can possibly obtain.

The question of treating cancer of the breast is much easier than the treating of cancer in the body. I feel with our present equipment we will obtain quite favorable results with cancer superficially located. Probably we can treat deeper cancers if we increase the focal distance from sixteen to twenty-four inches, or even to thirty-two inches. If you do, you need only one field. In treating supra-clavicular lymph nodes you must have even more homogeneous radiation than Dr. Erskine did. Not only that, but the difference between the surface and depth dose will be so small that the depth dose will be almost as intense as the surface dose.

Regarding the question of voltage, we all seem to be at sea. We do not know whether we should use our present machines or not. Last year when I returned from abroad a great many members of the American Radiological Society visited me and asked me if it was necessary to use the high voltage machine. I said, "No." I wish to repeat the answer I received from Professor Froelich when I asked him whether to do this work it would be necessary to get one of his machines. He laughed and said, "You can use any machine." I can see only one benefit from the high voltage, that is that you can use a higher filtration and save time and obtain a better ratio between surface and depth dose, especially in internal carcinoma. Consequently, the question arises in my mind whether it would not be better to treat a patient with a deep seated carcinoma with a low voltage in one sitting of say six hours instead of a high voltage for one-half hour.



DATA FOR CURVES IN FIG. 9

Sec- onds to Dis- charge at	Sec- onds to Dis- charge at	Milli- meters of Alumi- ni- um	Surface Depth	Ratio num (x-a)	1/(x-a)	Distance to Depth —50cm. Distance to Surface —40cm. KV=100 Y=Ratio X=Mm of Al Constant (x-a) (y-b)=C=Eq. of Curve.
2.7	21.8	8.1	0	3.45	.29	
3.7	25.7	6.8	1	4.45	.225	
4.9	30.1	6.1	2	5.45	.184	
6.3	35.3	5.6	3	6.45	.155	
7.4	38.7	5.2	4	7.45	.135	
9.4	46.2	4.9	5	8.45	.118	
11.4	53.0	4.6	6	9.45	.106	
			7			
14.2	60.0	4.2	8	11.45	.087	
			9			
18.7	75.0	4.0	10	13.45	.074	

Dermoid Cysts in the Thorax -- With a Review of the Literature

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I WOULD like to report the following case, not as a dermoid, but as a tumor mass in the upper chest evidently connected with the mediastinum.

The patient, a girl, age thirteen, presented herself for x-ray examination on October 28, 1920, with a request from the attending physician for examination of the cervical spine. Examination including cervical and dorsal spine and entire thorax was made with the following result:

There is seen a sharply defined mass occupying the left upper quadrant of the thorax extending from the mediastinum to the latter wall. The surrounding lung was normal in appearance. Heart shadow normal in shape, size and position. Left diaphragm shadow

higher than normal. There is a definite upper dorsal curve of the spine to the right with a compensating curve in the cervical region. No evidence of bone destruction in the spine. With this report in hand a complete examination of the patient was made November 22, 1920.

Family History: Father and mother living and well. One sister nine years living and well. None dead. No family disease.

Past History: Forceps delivery, but healthy as a baby. Measles and whooping cough at about five years. Mumps at seven. Always strong and robust until December, 1918, except for occasional cold in head. Development and nutrition seem to have been normal.

Present Illness: The mother insists that since two years of age, she has noticed the child's right shoulder higher than the left. There was no complaint of pain or anything else, however, until December, 1919, when she complained of pain in the left shoulder blade when she moved her arm, coughed or sneezed. Then the pain disappeared until March, 1920. At that time she had an injection of diphtheria antitoxin (prophylactic) followed in two days by return of pain in left shoulder. The pain disappeared again, returning in August, 1920, since when it has persisted, spreading to the right shoulder, down to the elbow, and to the left hand, involving the little finger and the next finger. The pain comes and goes, awak-

ens her usually at two a. m., lasts a few hours and then disappears. Five days ago she stumbled on a rug and later in the day she stumbled again and fell. No disturbance of gait had been noticed before this except that she wore out her left shoe faster than her right. In the past five days she has walked stiffly and has stumbled almost every day. No cough or disturbance of respiration. Vision seems good. Has not menstruated. Slight loss of weight.

Examination: She is a small girl, somewhat under-developed and under-nourished for her size. Weight seventy pounds (normal weight ninety-one). Color is good. Gait, spastic ataxia. At rest there is some choreoform jerking of the arms.

Head: Left pupil about half the size of right, but both react to light and accommodation. Slight ptosis of left lid. Ears negative.

Nose—Left nares smaller than right (old fracture?) Sinus infection left. Deviated septum with left obstruction.

Mouth—Both tonsils large and crypts infected. Palate and uvula move symmetrically. Tongue in mid line.

Chest: Spine—Rigidity of neck so that she can't put chin down on chest. Marked cervical curvature to left, apparently compensated by lower dorsal to right and lumbar to left. Brawny swelling above left clavicle up about two cm. Costal margins move freely and symmetrically. Upper three ribs on left do not move. The superficial veins on left from third space to shoulder are dilated. Right scapula is winged, but there is good control of all the shoulder muscles. On percussion flat on left above and below clavicle and down to spine of scapula and to second rib in front. Normal resonance below clavicle, hyperresonance on right. Absent breath sounds over flat area, clavicle tubular breathing at borders and increase in voice sounds; relatively normal below when a few indeterminate rales are heard. Increase in normal sounds in right. Cardiac dullness not increased or misplaced. Tones clear. Rate rapid—over 200. Abdomen negative.

Reflexes: Eyes normal except size of pupils. Abdominals absent. Knee jerks and ankle jerks inward. Ankle, clonus both sides. left greater than right. Babinski

plus both sides. External maleolar sign gives fanning both sides.

Sensation: Sharp and dull show some impairment left seventh space down, right third space down to feet. Touch remains, but is poorly localized in feet.

Musculature: No paralysis but spastic ataxia of arms and legs, beginning bilateral foot drop. No atrophy, etc. Right scapula wings as though the Romboid is paretic. Grip left hand less than right.

Urine: Acid. 1018. Albumin negative. Sugar negative. Microscopic negative.

Blood: Hb. 85 (Dare) W. B. C. 9800.

P. M. N.....	60
P. M. E.....	1
P. M. B.....	1
L. Lympho.....	21
S. Lympho.....	13
Trans.	4

Diagnosis: Tumor of the lung probably a dermoid (possibly an echinococcus cyst) with involvement of the cervical cord caused either by direct pressure or metastasis.

On November 24th a subsequent x-ray examination was made in which the fluoroscope was used and additional plates made. The tumor is as well defined as in the previous examination. There is some evidence of an increase in size. The density of the tumor is equal throughout. There is no pressure on the esophagus. The tumor is not expansible, but moves with pulsation of the heart. The heart is pushed to the right. There is complete eventration of the left diaphragm which does not move on respiration.

On November 29th a physical examination was again made with the following result: the tumor has increased in size, as shown by increase in bulge above and below left clavicle and extension of area of flatness. The heart is now placed to the right about four cm. beyond sternum and the apex has come in to correspond. The spasticity of legs and foot drop are more evident.

Subsequent history: The spastic condition of the patient increased so that within a few days after the last examination she was confined to bed. No great amount of cough or dyspnea was developed at any time during the subsequent course.



Figure 1.—Posterior anterior view showing mass in left upper chest.

The patient suffered but little pain and was apparently in about the same general condition for six weeks, when respiration began to be slower and shallower, and she died in this condition. No evidence of rupture of the tumor was seen at any time. Postmortem was refused and a confirmation of the diagnosis was impossible. I want to thank Drs. Doherty and Grosh for the physical examination of this patient.

As to frequency of dermoid cyst in the thorax, several reviews of the literature have been made. Dangschat in 1902 collected forty-four cases. Morris in 1905 was able to find fifty-two cases. In 1916 Hertzler made a very exhaustive review of the literature and found seventy-two cases, to which he added one of his own. Harris in 1919 reviewed the subject thoroughly, added a case of his own and found nineteen additional ones in the literature, making a total of ninety-three. To these collected reports I have been able to add nineteen well authenticated cases, making a total of 112. Hertzler in his review, taking the cases reported previously for age, found that the majority of cases were between twenty and thirty, but that cases have been reported from infancy to past fifty years. In eleven of the nineteen additional cases the ages were not given. One case was under ten years of age, four under twenty, three under thirty, four under forty, and one between forty and fifty. None of these cases exceeded fifty years of age. The sex of the patients was about evenly divided between male and female. In ten cases it was not noted. Of the remaining nine cases, five were males and four females.

Dermoid cysts have been found occupying all portions of the thoracic cavity. The most common portion, in previously reported cases, has been the upper mediastinum between the sternum and the great vessels. Some cysts extend from the sternum to the diaphragm, displacing the lung. A case of dermoid has been reported anterior to the heart, displacing this organ and the pericardium backwards. The locations of the growths in the additional cases reported show ten to be in the anterior mediastinum, three on the right side, and in six the part of thorax was

not stated. The origin of dermoid cyst in the mediastinum is closely associated with the thymus gland. Its close relationship between the ectodermal and the entodermal elements of the neck has been frequently pointed out. That the tumors have their origin near the upper portion of the sternum is evident, as even the tumors which exhibit their bulk in the lower thorax retain their attachment higher up. It is admitted by all investigators that apparent tumors of the lung itself have their origin in the mediastinum. At first glance it would seem difficult to account for the presence of a large dermoid in the thorax, but a review of the development of the sternum throws much light on the subject. The two halves of the sternum in the embryo are widely separated from each other and coalesce in the median line. This coalescence is liable to be faulty and a condition analogous to spina bifida is produced. In this line of coalescence we have skin line recesses. Should a piece of skin become sequestered during the development of the sternum

it may become dislocated forward to the outer surface or backward to the mediastinum, a condition in every way parallel to the variations in the position of cranial dermoids. The microscopic appearance of these tumors is usually a smooth, rounded mass, sharply outlined against the normal structure of the lung. This description, however, only fits the classical case, one that has presented only slight symptoms. These tumors seem to have the faculty of causing an irritation of the surrounding lung tissue, due to some changes of the contents, which inflame the sac and irritate its environment, causing a pleurisy and an exudation that may greatly resemble a pneumonia. In the tumors of longer standing the picture may be different. Multiple cysts may form, the surrounding inflammation and pressure may cause consolidation and erosion of the lung, rupture into a bronchus, erosion of blood vessels with sometimes very large hemorrhages and all the conditions that go with a rapidly growing



Figure II.—Anterior posterior view showing mass in left upper chest. Dermoid Cysts in the Thoracic Cavity.

mass inside of a closed cavity may occur.

Dermoids in the thorax present two different types, one the simple dermoid, in which are found only tissues of epidermal origin, the other the teratoma, in which tissues of all three layers are combined. The simple dermoids are single or multilocular cysts with smooth epidermal lining, this lining at times contains dermal glands and incloses hair and sebaceous material. The teratoma are complex tumors which may contain beside epidermis, bone, cartilage, tissue from the nervous system, the thyroid, the intestinal tract and respiratory ciliated epithelium. Authoritative statements from the literature point to the fact that most dermoids are of the tridermal type, and it is probably always tumors of this type that undergo malignant degeneration. At least one solid dermoid tumor of the mediastinum has been reported, an important point to be noted later under diagnosis.

The symptomatology of dermoids consists of two distinct types—the simple dermoid causing its symptoms mainly by its presence, and the cyst that, for some reason, has become an active irritant to the part in which it lies. The symptoms of a simple dermoid are usually of the pressure type, reflex cough due to pressure on nerves, dyspnea and pain. Pain in the chest is often one of the earliest signs that can be elicited in the history of the case. The secondary symptoms are those due to the involvement of the surrounding organs, pleurisy, irritation of the bronchi with the expectoration of bronchial mucus, rupture of the cyst into a bronchus with the expectoration of contents of the cyst such as hair, sebaceous material and a honey like fluid due to a mixture of the contents with the bronchial mucus.

Differential Diagnosis: Usually these tumors are of a size great enough to give a definite dullness over their location. The majority of tumors being in the upper portion of the chest, dullness extending upward toward and into the supraclavicular spaces is suggestive. In the larger tumors the dullness often occupies a great portion of one side of the chest. In some cases a definite bulging of the supraclavicular space, due

to a tumor mass projecting upward from below with a boggy feel, adds another point to the picture. Fixation of the ribs during respiration with absence of breath sounds and rales and increase in voice sounds are found over the flat area. Examination of the sputum with a discovery of hair and sebaceous material is diagnostic. The sputum has often a glycerine-like appearance. The absence of pus cells may differentiate from an abscess of the lung or an empyema. Tubercular bacilli may be found and help differentiate a tuberculosis, but Harris calls attention to the fact that in a number of cases both conditions have been present at the same time. The use of exploratory puncture is pathognomic if cyst contents are obtained. It is also pathognomic in echinococcus cysts: if the hooklets are obtained. Puncture of these latter cysts may be dangerous, as a grave toxemia may follow from absorption of the fluid. Maydl reported eleven fatal cases following thoracentesis. Eosinophilia and the Bondet-Gengu reaction are positive when present, but not very reliable. The history of a patient coming from a region where echinococcus disease is prevalent is suggestive. The surrounding reactive inflammation may cause a greatly thickened wall excluding the needle from the cyst itself, or, as in the case reported by Christian in the Journal of Medical Research, the tumor was a solid teratoma, operatively removed with good recovery. The differentiation between aneurysm would depend upon the eliciting of the classical signs of this condition, the age of the patient, the presence or absence of a positive Wasserman, the presence of pulsation in the tumor mass, expansion under fluoroscope, etc. Differentiation from empyema will depend upon the exploratory needle. Puncture of the cavity with the extraction of pus accompanied or followed by an acute condition of fever and chills establishes this condition.

In malignant tumors the usual rapid course of this condition, with cachexia and loss of weight in counter distinction to the long history of dermoids, is an important point, however, when a dermoid becomes infected its

increasing growth may be as rapid as that of a malignancy and the early symptoms may not have been noted. Benign tumors of the thymus and lipoma have presented pictures that closely simulate dermoids and the diagnosis here would depend upon findings of the symptoms already mentioned in this condition. A differential diagnosis, however, is very difficult. Intrathoracic goiter may present a picture adding new difficulties to the diagnosis. The tumor mass in the latter condition is usually bilateral, roughly wedged shaped in appearance with the apex of the wedge downward, blending into the great vessels below. In Hodgkins disease the tumor masses are usually multiple, may or may not be bilateral, and the presence of enlarged glands in other portions of the body is a great aid in the diagnosis.

Prognosis and Treatment: Many of these cases present histories running over long periods of time. The common cause of death has been hemorrhage and dyspnea. The size and situation, together with the reactive changes which take place in and about the tumor are the determining factors. Except in very small tumors and favorable situations, it is safe to say that the patient's life will be in danger eventually unless the tumor is removed. Malignant degeneration occurs in a small percentage of the cases. The majority of the patients have presented symptoms over periods varying from one to five or six years. It is evident that the only treatment that can be of any avail is surgical. Of the cases found by Hertzler, twenty-seven were operated upon with a recovery in five cases, improvement in thirteen, in four the result was not stated, and five died as a direct result of the operation. In the nineteen cases reported by Harris, seven were treated by incision and drainage of the cyst cavity, of these three died, one made a complete recovery, two an incomplete recovery, and in one the result is not recorded. In five cases the cyst was completely extirpated, of these four recovered and one died. Seven cases were not treated, and in five the results were not recorded. In the nineteen additional cases which we have been

able to find, four were not operated upon, diagnosis being confirmed by autopsy, in four cases the original reports are not available, seven cases were operated with complete recovery, two were operated upon with a partial recovery, one requiring a secondary operation and one having a fistula remaining, and two died at operation. Harris, Bastiandi and Von Isenberg recommend total extirpation as the ideal treatment, but in many cases, as in one recorded by Pervis and Oudard, in which the mass consisted of five tumors, radical removal was found impossible and the patient died, autopsy showing a vast tumor in the right half of the thoracic cavity weighing 1.65 kilos. Death in this case followed later due to rupture in the pericardial cavity. From these cases it is seen that the operative removal is not impossible, as, following the operation in the fifty cases in only part of which it was possible to do a complete removal, thirty-nine cases survived and were improved by the operation. It is obvious, therefore, that surgical treatment following an early diagnosis is the method to be employed in the treatment of these cases.

In addition to the cases reported by Hertzler and Harris, the following have been found in literature:

1. Stilling: Eine Flimmercyste des Mediastinum anticum. Arch. f. path. Anat., 1888, cxiv, 557. Patient a man forty-five years old. Tumor found on autopsy and histologically verified. (Teratoma).

2. Hermann: Ueber eine Flimmercyste d. mediastinum. Prag. med. Wehnschr., 1890 xv, 146. The original report is not available.

3. Atlas, A.: Teratoma cysticum mediastinum, anterioris. "Yuzhno russk. med. gaz.", Odessa, 1894, iii, 633. "Allg. Weiner med. Ztg.", 1894, xxix, 502. Age of patient, twenty-four years. Died in hospital from dyspnea and cyanosis. Autopsy showed large cystic teratoma (dermoid) in left upper side of anterior mediastinum compressing aorta, etc., and ruptured into bronchi, etc. No histological examination mentioned.

4. Fletcher: A Congenital Cyst of the Mediastinum. Trans. Path. Soc. of London, 1896-7, xlviii, 249. Girl of six years. Died in hospital of dyspnea,

cyanosis, etc. Autopsy showed cyst lying posteriorly to right bronchus, cyst lined with ciliated epithelium. Author thinks cyst has arisen in connection with fetal esophagus.

5. Medvel: (Dermoid cyst coughed up in pieces by nursing). Orvosi hetil. Budapest, 1901, xlv, 735. The original report is not available.

6. Christian: Solid teratoma of the mediastinum. Jour. Med. Research, 1917, xvi, 275. Operatively removed with good recovery.

7. Opokin: Dermoid cyste der Lunge. Russ. Archiv. f. Chir. Abstract in Zentralbl. f. Chir., 1908, xxv, 144. Patient aged twenty-three years. Operated for supposed lung abscess; found dermoid cyst ruptured into bronchus and lung. Recovery complicated by fistulae, etc.

8. Morestin: Kyste dermoide du creux sus-sternal. "Bull. Soc. Anat. de Par.", 1912, lxxvii, 395. Patient a woman, of thirty years. Tumor exactly median. Successfully removed by operation; verified histologically.

9. Katase: Ein seltener Fall von Lungenteratom. "Centralbl. f. allg. Path. u. path. Anat.", 1912, xxiii, 146. Man of forty-four. Dermoid cyst of the right lung diagnosed intra-vitam; not operated; diagnosis verified with histological examination at autopsy.

10. Schusterowna: Cancer of the wall of a Dermoid Cyst of the Anterior Mediastinum. "Gaz. ek. Warszawa", 1913, 25, xxxiii, 355. Original report is not available.

11. Fohl: Ueber Mediastinal Dermoid. "Deutsche Ztschr. f. Chir.", 1914, cxxx, 481. Infant, operated in hospital. Died during operation. Autopsy, histology, teratoma (dermoid) of the anterior mediastinum.

12. Perves and Oudard: Kyste dermoide intra-thoracique. "Arch. de med. et phar. nav. Paris", 1914, ci, 120. Man, twenty-seven years. Five tumors. Radical removal found impossible after resection of fourth and fifth ribs. Patient died. Vast tumor in right half of thoracic cavity. Histologically a dermoid cyst. Weighed 1.65 kilos. Death due to rupture of cyst into pericardial cavity.

13. Bendz: Case of Teratoma of the Upper Thorax. "Hygiea", Stockholm, 1915, lxxvii, 1336. Original report not available.

14. Naegeli: Extirpation einer Dermoid cyste des vorderen Mediastinums. "Beitr. zur. klin. Chir.", 1918, cx, 672. Dermoid cyst of the anterior mediastinum successfully extirpated. Verified histologically.

15. Payr: Fall von radikal operierten Mediastinal Dermoid. "Muenchen. med. Wehnschr.", 1918, lxxv, Case similar to foregoing.

16. Sonnenschein: Dermoids of the Anterior Mediastinum. "Ann. of Otol. Rhinol. and Laryngol.", 1920, xxix, 427. Woman of thirty years. Mass believed to be thymus operated. Tumor which was histologically a dermoid cyst removed. Good recovery.

17. Kleinschmid: "Muenchen. med. Wehnschr.", 1920, lxxvii, 862. Reports two cases. In first case pleural cavity was found perforated. Secondary operations necessary on account of fistulae, etc., and to avoid infection. Histologically a dermoid. In second case, the cavity was closed at once and healed primarily. Radical operation with primary suture obtained very rapid recovery. Histologically a dermoid cyst.

18. Hale: Medical Rec. N. Y., 1920, xcvi, 1019. Fluctuant tumor. Chest opened; owing to adhesions tumor could not be enucleated, but was evacuated. Recovery.

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- 17—Ewing: Neoplastic Diseases. Philadelphia, 1919.
- 18—Christie: Diagnosis of Primary Tumor of the Lung. Amer. Jour. of Roent., March, 1921, viii, 3.
- 19—Stevens: Malignant Diseases of the Lung with special reference to sarcoma. Amer. Jour. Med. Science, cxxxviii, 193.
- 20—Crow: Echinococcus Disease of the Lungs. Amer. Jour. of Roent., Nov., 1918, v, 2.
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*—Read at mid-year meeting, Radiological Society of North America, Boston, June 4, 1921.



The Pulpless Tooth and Root Canal Treatment of the Periapical Abscesses. Their Influence on Extraction as Indicated by the X-Ray Examination.

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I AM approaching this subject from the point of view of a physician and roentgenologist, an interpreter of the x-ray film in terms of pathology. My interest has fostered a close study of the whole situation, including the opinions and writings of the dentists of the present time, so that I have not only my own observations as a medical man and roentgenologist to draw upon, but also the attitude of the dental profession as a whole. Your time and attention will be conserved if I select for you from dental literature what is basic. I am following and agree with a few dentists whose names you should remember and whose work you should follow closely—such men as Grieves, Black, Talbot, Thoma, Logan, Hartzell, Dewey, Noyes, Box, also physicians such as Billings, Haskins, Rosenau, Barker, etc.

Dr. Clarence J. Grieves, Oral Surgeon for Johns Hopkins Hospital, where, among others, he works in close relationship with Dr. L. F. Barker, has covered this subject in a very comprehensive way in his article which appeared in the April, 1921, issue of the *Journal of the National Dental Association*. His classification of the teeth based on the extent of their disease I shall summarize, along with his conclusions which he recommends as good practice in treating the different classes. In introduction he says: "It is next to impossible for dentists to consult intelligently among themselves upon this subject. How, then, can they expect their medical conferees to comprehend in oral pathology what, to their own minds, is not clear"?¹ He then offers this classification as a clinical

discussion with a double object in view; first, to clarify the subject in the minds of the dentists themselves and save countless, otherwise functional, teeth; second, to promote a better understanding, and closer co-operation between both dental and medical professions.

In order to get the anatomy and histology of the tooth and the alveolar process clearly in mind, and the relations of the lamina dura study carefully Fig. 1.

Class I.—Average Teeth; Pulpus Vital

"Conclusion 1. Dental caries is dual in character, being a chronic tooth-wasting disease, with tissue necrosis or liquefaction superficially, and pathogenic forms irregularly invading the hard underlying dentinal matrix. This sepsis begins in the granular layer of Tomes, and is the primary infective focal portal. Therefore, because dentin is hard, or free from soft caries, it is not necessarily free from bacteria; and some effort must be made to sterilize every cavity-preparation in vital teeth.

"Conclusion 2. The normal pulps of vital teeth should be devitalized rarely.

Class II.—Sound Teeth; Pulpus Diseased by Pyorrhea.

"It is not proposed, in discussing Class II. to dwell upon gingival diseases, except as they tend to produce pulpal or periapical disease."

"Dewey and Noyes^{2,3} have demonstrated the association of three sets of lymph vessels with the blood supply that completely surrounds every tooth, which is seated, so to speak, in a basket of periodontal membrane, dense socket lining (lamina dura), and blood vessels, all of which tissues these lymph vessels penetrate, nourish, and drain. The largest group passes from the gingiva, centrally down through the membrane, paralleling the cementum; it is joined by gingival middle third groups, the first of which carries infection from gingival crests to the nearest lymph nodes. Thus, a superficial gingival infection would be deflected over the interseptal crests; but a perio-

dontal infection would finally reach the subapical tissues, splitting the periodontal membrane on its way, as in a true pyorrhea pocket.

"At this point we would impress you with the results of recent research by Henrici and Hartzell⁴ who, in studying one hundred coronally sound, but pyorrheal teeth, found forty-eight per cent of the vital pulps invaded by lymphocytic infiltration and the vessel walls much damaged, with coccal forms definitely established in the tissue. These findings should settle the question of hematogenous pulp infection.

"Conclusion 3. Any pulpless tooth, the periodontal membrane of which is gingivally purulent, should be removed, no matter how perfectly filled, or how well repaired subapically, whether periapically diseased or not; for, at any time, it might become diseased by the gingival pathology. If pulp devitalization is absolutely necessary, it should be practiced on only such pyorrheal teeth as are not swaying to the middle third; or those cured (?) by peridontic treatment; and then, on only those in which apical hyperplasia has closed in part the foramina as noted. (Such hyperplasia is usually demonstrable, clinically and by good radiographs.)

Classes III. and IV.—(III.) Abraded or Eroded Teeth Occasional Pulp Symptoms; (IV.) Average Teeth; Pulpus Diseased.

"Conclusion 4. Unless pulp symptoms or exposure arise in eroded, abraded or senile teeth, it is meddlesome practice to risk pulp devitalization and defective canal filling, just because pulps might degenerate, the exception to this rule being pyorrheal teeth, which might be infected by the gingival pathway.

"In all stages of degeneration, except the calcific, when the pulp is finally infected by opening the pulp cavity or otherwise, periapical disease is both rapid and virulent. This is to be expected and illustrates a lack of the usual resistance, resident in healthy dentin and pulp; for pulp cells are

*—This paper is an abstract of "A Classification of Teeth, the Diseased Pulp and Apices of which are Related to Infective Focal and Systemic Sequelae," by Clarence J. Grieves, D. D. S., Baltimore, Md., published in the April, 1921, issue of the *Journal of National Dental Association*. This article, as originally prepared by Dr. Grieves, was first published in the September, 1920, issue of the *Journal of Dental Research*.

fibrotic, fatty, or gangrenous, as are the fibrillae. The entire tooth is thus a perfect culture tube.

"Conclusion 5. Cases in Class IV, (fresh surgical exposure of symptomless pulps, made through hard dentin, even at the risk of its being infected) are hopeful. Capping should be attempted, with frequent clinical and radiographic survey; but the slightest periodontal symptoms demand immediate pulp removal. This is especially true of young unfinished apices, which should be considered with a full understanding of the results of the recent research on apical cementum by Box.⁵

"No pulp exposure with the least symptoms of any disease, except calcific degeneration, should be capped, for periapical infection is inevitable, insidious, and symptomless, hence dangerous.

Class V.—Carious Teeth; Pulp Infected.

"Class V. (carious teeth, infected pulps, but subgingival dentin not completely infected, with the apices free from disease and vital) is most interesting, because it is in this group that the profession, in the past, has done its best work.

"In all data submitted, the radiograph and its interpretation is a determining factor. While open to criticism, which will be discussed later, the radiograph, within clinical limitations, is the means by which the extensive occurrence of such lesions was first definitely discovered, not only about teeth, but in many other organs. It is still accepted as a most valuable diagnostic adjunct by the surgeon, so this is hardly the time for dentists to quibble over it.

"The following deductions are justified, from the standpoint of histopathology, as relating to

conditions that guard the apex and prevent or delay its infection.

“(A) In chronic pulpitis, and certain stages of pulp degeneration and gangrene, complete destruction of the subgingival odontoblasts and fibrillae is usually a slow process. Persistence of this layer of cells, vitally attached to pulpal walls, has been noted by many histologists, for all pulp diseases. It guards the apical third of the dentin, possibly transmitting sensation, which often persists, indicating a vital apex. Such would not be the case, if this layer was necrotic or liquefied.

"(B) alpal infection is generally localized centrally. Excepting the initial lesion, the carious exposure, it follows the large vessels and perivascular lymphatics centrally through the pulp, leaving tissues adjacent to dentin and cementum intact for some time. Indeed, this pathway is more accessible for the production of periapical disease than of general infection of the apex.

“(C) The presence of nerves, under these pulp conditions, sufficiently nourished and functional to record pain, denotes a persistent vascularity. The common resistance to arsenic, cocaine, and other medicaments, offered by many stages of chronic ulcerating and granulating pulpitis, is hopeful, and indicates activity of nature's usual granulation methods, protecting the apex and contained vessels against infection.

(D) The results of recent research, by Box⁵ conclusively demonstrate a complete circulation of tissue fluids, through the cemental apex from the periodontium via the lacunae and canaliculi, the granular layer of Tomes and dentinal fibrillae, to the apical third of the dental pulp. This condition emphasizes the source from which the cemental matrix of a vital apex, and possibly apical pulp-shreds and vessels, are nourished; for they are thereby in touch with serologic factors, which not only fight infection, but prevent it. It is a most hopeful feature; but, when once this labyrinth is infected, these lines of communication become pathways by which sepsis passes into the apical periodontium, destroying and detaching it, and creating a thoroughly septic, necrotic, apex and periapical disease.

“(E) There is the further fact that this means of communication

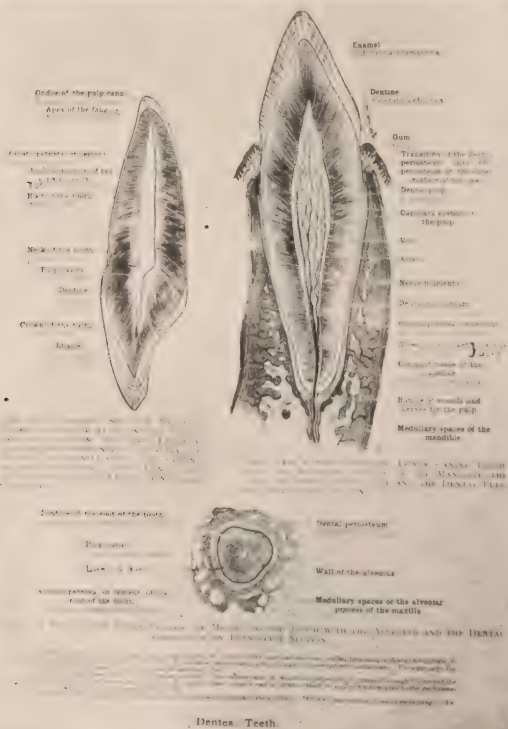


Figure I—Toldt's Anatomy, Part IV, Page 426. In order to get the anatomy and histology of the tooth and the alveolar process clearly in mind, and the relations of the lamina dura study this illustration carefully.

cannot be demonstrated in middle third cementum (5), the first circumferential lamella (lying next to the granular layer of dentin) of which is unorganized, with no connecting canaliculi crossing it from pulp to periodontium. This is, indeed, a protective feature, for, if infection can be prevented from reaching the apical dento-cemental communication, a definite barrier exists against it in the middle and gingival thirds. If this were not true, alveolar abscesses would commonly occur beside the root on the middle third, as paradidicular, instead of periapically on the apical third.

"What may we expect of future canal surgery? It has been demonstrated by Brooks and Price⁶ that dentin and cementum of experimental 'dead' teeth in the laboratory, once thoroughly saturated with a known and virulent infection, cannot be sterilized except by agents destructive of normal tissues. This is even more true of a tooth in situ, many statements to the contrary notwithstanding. If dentinal and apical cementum cannot be sterilized, and canal medication is worse than useless; if, as shown, very few apices have ever been filled, except by leaking fillings; then all the canal work of this period was useless and all teeth so treated should be periapically diseased.

"Conclusion 6. For the teeth of Classes I, II, III, IV, and V, diagnosed carefully and promptly; If pulps can be removed under as nearly aseptic conditions as possible, by careful chemo-mechanical instrumentation, leaving only inaccessible vessels and vital pulp-shreds in the immediate foraminal openings of a vital apex, which has not been cauterized nor over sterilized; or, if these strong agents can be used without their passing out into the membrane (though conservative operators prefer milder medicaments)—if all this can be accomplished without perforation and encapsulation, avoiding infection from debris, then any canal-filling method, as nearly aseptic as can be, that will close these openings well into, but not through, the apex, will insure apices infected as little, and filled as much as possible, and functional teeth⁷.

"How are we to distinguish as between the periapically diseased tooth, where this has resulted in the subapical tissues, in touch

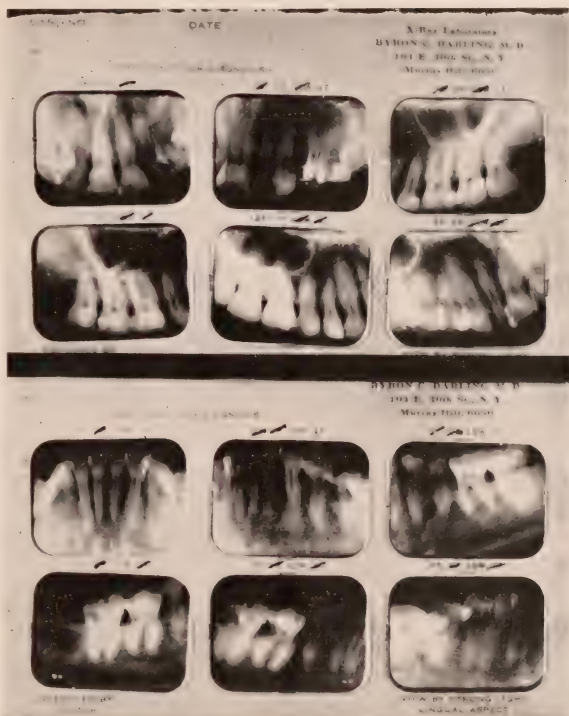


Figure II—The lamina dura is here shown fairly well as the cortex of the socket. In the left upper first bicuspid where the tooth has been treated and there has been cancelled bone restoration the lamina dura has not been restored. According to Grieves this tooth should be extracted.

with the blood stream (Class VI), and the apically well filled pulpless tooth, where it has not occurred (Class V)? The answer lies in correct diagnosis of the apical disease, defining the normality of the attaching tissues, namely, cementum, periodontal membrane and alveoli; all equally as important as, if not more than, the pulp.

"The laminated cementum is built by and in the fibrous periodontium. Both are developed according to age and use. The laminae and fibers of both respond to every stress throughout life by repair, which is not uncommon even in controlled infection. These are no more important, attaching the tooth, than the dense lining of the alveoli known as the lamina dura, see Fig. II, which receives the insertion of the osteal ends of these fibers. If the cells of these tissues lie in physiologic apical contact, attaching a well filled tooth from which the pulp has been removed; that tooth is

healthy, no matter whether it be called a 'non-vital,' 'pulpless', or 'dead,' tooth (8). When this contact is broken, periapical infection exists beyond the tooth and can best be diagnosed by radiographic study, modified by clinical symptoms. 'Principal among the clinical bony landmarks stands the character and stability of that hard lining of each alveolar socket known as the lamina dura * * * Showing as a dense line surrounding each tooth, uniting with its neighbor to form the inter-septal crests, supported by trabeculae, which are important, it defines circumferentially the normal width of the periodontium. Its disappearance in areas, particularly in middle and apical thirds, with thickening of the dark line representing the periodontium, indicates undue stress or proliferating periodontitis. It may be completely fused in this region by normal cemental repair, or the hyperplasia may progress to a hypercementosis. It is mis-

ing in cemental hypoplasia and denudation, or when the periodontium is destroyed in the midst of suppuration, granulomata, unorganized granulations or cysts. * * * Lack of continuity in the lamina is undoubtedly a most valuable symptom of infection advancing beyond the tooth, and, clinically, if it be intact, the cementum should be considered healthy.

"The radiograph taken and developed according to the latest technique by those familiar with facial and dental anatomy, in form generally of intraoral films, sometimes extra-oral plates, is simply indispensable".⁷ Serious pararadicular disease is occasionally masked by roots paralleled or superimposed on the film; but **periapical rarefaction**, occurring around the apex, is always visible and **diagnostic of a dead apex**; about which the subapical bone can never form, for it is negatively chemotactile. Bone repair and sclerosis may occasionally present as dense a shadow as cortical bone, but the trabeculae and partitions of the adjacent normal bone, to which these should be compared, are missing.

"Sequestra occasionally seem more radiopaque than normal bone and rarefactions may result systemically from osteoporosis, osteomalacia, pregnancy, or calcic waste; in fact, many unusual factors may, but rarely do, appear. * * * Exceptional cases cannot be compared with the usual, and should not be quoted, disturbing confidence of honest operators seeking help, nor can they be used by dishonest operators seeking an excuse".⁷

"Conclusion 7. If pulp removal and canal filling can be accomplished according to the conditions specified in Conclusion 6; if the lamina dura is definite, and surrounding bone cancellations appear to be normal, as in adjacent vital teeth; if there are no clinical symptoms and the apex is not hypoplastic, but contains a filling **well into, but not through** it, with no visible open canal beyond; then a pulpless tooth so situated should be retained, as it is functional and harmless.

"Because of inoperable canals and multiple foramina, the superior molars and canines, and the inferior molars, are occasional exceptions to this rule, which should be kept under survey. If periodontal symptoms arise, the

affected teeth should be promptly extracted.

"Conclusion 8. General nutrition may be seriously disturbed, and great distress caused the patient, by indiscriminate removal of Class V (apically well-filled) teeth, for diagnostic purpose or because infection is suspected. Such operations are frequently peremptorily ordered by medical men in their anxiety to cure disease and in ignorance of oral pathology. Obviously, such teeth extracted by a dentist, who, if he does not protest or refuse, but operates following a fad or through fear, or to please, his medical confrere, undoubtedly damages the patient's health and lowers the dignity of his profession.

Class VI.—Infected Teeth; Septic Pulp.

"There is little use in consuming time for a consideration of the teeth of Class VI (infected teeth, septic pulp, involved by periapical disease.) They have been much discussed in former papers Dr. Grieves five papers, 7 9 10 11 12 and are really not worth while, for the reason that no adequate treatment is shown which will certainly cure the **suppurative, granulating, or cystic**, phases of apical disease, except surgery. This statement implies recourse to (a) **apiectomy**, which is rarely successful, because the apical section of dentin and cementum, left by the operation, is not sterile, and generally, if such tissues are sterile, apical disease does not exist, hence there is no need for apiectomy; or (b) **extraction**, which obviously destroys the tooth, but does not cure the bone lesions, except when followed by (c) **curettement**, the third and most important surgical expedient.

"A cure of periapical disease may be defined as regeneration of the lamina dura and associated trabeculae, comparable to adjacent areas on vital teeth or other operated areas, following extraction and curettement. It should result promptly (in four months) and the new bone should be deposited to a line the width of other periodontal membranes, in the same mouth, and the tooth must be clinically correct. Such repair is indeed rare. It has been noted occasionally in acute cases, where subapical tissues were sharply infected by acute purulent pulpitis, and were as quickly

relieved of exudates by prompt drainage and canal treatment. These cases reverse the rule, which is that of a primary chronic infection, usually followed by an acute secondary parulis or fistulous abscess, associated with a necrotic apex. Any treatment of this latter type seldom succeeds; subapical bone may appear, as if repaired, but soon breaks down, invading a larger area. Hence:

"Conclusion 9. With the exceptions mentioned, all periapically diseased teeth, when clinically and radiographically definite (Class VI) should be promptly extracted and sockets curetted. If there be the slightest question, it is better to err radically, and remove a **doubtful** tooth, than to risk inevitable damage to adjacent teeth, attaching tissues, or the maxillae and possibly the patient's health.

"Many medical men, principally pathologists, believe the oral focal infection idea to be much overdone. Others do not subscribe to it at all. Whatever the outcome of this disagreement, we conclude as follows:

"Conclusion 10. Dentists generally must surgically remove all such lesions, regardless of whether they be infected or not, because a real chronic bone pathology exists about the tooth and its cell reactions often simulates malignancy—it eventually proliferates, undermining the denture. So, obviously the dentist, quite as urgently as the physician, and certainly the patient, desire prompt action to prevent further bodily invasion.

"The writer (still quoting Dr. Grieves) is just as confirmed a believer in the doctrine that apically diseased teeth (Class VI) are infective foci, which may cause systemic disease, as he is in the fact that **pulpless, apically well-filled, apically healthy teeth** (Class V) do not produce systemic disease and should be retained. The relation of these lesions, to the various systemic diseases with which they are associated, has been discussed in previous papers.^{9 10 12}

"From an entire **pyorrhetic denture**, undermined and swaying in purulence, to a single locked periapical area walled off by **condensing osteitis** or sclerosis, nature's best protective procedure, is a far cry in pathology; and yet we know the former may do less systemic harm than the latter; just as the hypertrophic pus-ton-

sil may not be a focal factor, while the apparently normal tonsil, with its virulent crypt, may be most active.

"The closure of oral infective portals, if attempted at all, should be uncompromising. Only by promptly ruling out all systemic foci will 'the fight long continued against a minute but daily toxic invasion be won; and those principles should be applied equally to all who consult us, either sick or well' ¹².

"Quoting Dr. Grievies, 'the dentist who, without medical assistance of the highest order, attempts to distinguish between the sick and well patient, ignores recent experience of the Medical Advisory Draft Boards, where it required ten specialists, of whom one was a dentist, to diagnose an ambulant man, to say nothing of a sick one. The dentist presumes by a glance and a few routine questions to determine, instantly, matters which might keep hospital laboratories busy for days. We dabble superficially in internal medicine, when we do not know the actual etiology of or sure treatment for a single dental disease."

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*—Read at midyear meeting Radiological Society of North America, Boston, June 4, 1921.

DR. A. F. TYLER, Omaha: This subject is so very important that I feel we ought to emphasize the points that have been brought out by the two essayists. When we consider that 90 per cent. of all foci of infection that produce disease in the body are located above the clavicle, we can readily understand the importance of a definite knowledge about the pathology of the teeth and accessory sinuses and tonsils. The radiologist must sit down with the dental anatomy and get a knowledge of dental anatomy and then take up the dental pathology in order to be able to accurately interpret dental radiographs. The chief argument that occurs between the medical radiologist and the dentist is that the radiologist has not had sufficient foundation in dental anatomy and pathology. After that has been done, I think it is highly important for every radiologist to make a physical examination of every mouth of which he makes films of the teeth. He can see if there is pus coming up around the teeth and he can thus tell whether a pyorrhoea is active or quiescent. Another fact is that you never find a periapical abscess at the end of a vital tooth. That means in certain films in which you see an area of rarefaction around the tooth without an opaque filling in the canal that you must be careful. Test that tooth for vitality. So important are these facts that it has been our routine to test every tooth for vitality. Another thing is that x-ray plates should be carefully made. Many times infection around the tooth will be on the buccal or lingual sides and we cannot see it unless we take another plate of the tooth at a different angle. Remember, osteomyelitis of the bone of the jaw is no longer a tooth disease and that the area of the disease is always larger than that shown on your x-ray film.

DR. H. A. OSGOOD, Boston, Mass.: Dr. Tyler has brought out some points which cannot be over-emphasized. In the past five years we have made over 5,000 radiographic examinations, and it has been shown that rarefaction at the apex is a minor point in diagnosis. A diagnosis is based on the structural changes in the pericementum. These changes are characteristic in a good radiograph. It is possible, for example, to differen-

tiate a chronic abscess from a granuloma by these changes, and on this diagnosis treatment is based. Not one film in fifty, however, shows sufficient structural detail at the apex to make a diagnosis. The tendency is to get beautiful films which do not show line detail. I have been able, with the portable Coolidge tube and the gas tube to take satisfactory films, but have not done so with the larger Coolidge tubes. I believe that if we do take satisfactory films we can make an accurate diagnosis on which the dentist can base his work. Inaccuracy of diagnosis is a chief criticism of dental radiology today, and is largely due to lack of sufficient detail in the radiograph to show the characteristic structural changes on which diagnosis is based. I have seen extracted granulomata as large as a bean which failed to show rarefied areas at the apex, but did show the characteristic markings about the pericementum. Under appropriate treatments it is possible to clear up small granulomata so that several years later nothing can be seen except a very slightly thickened pericementum. I think the pendulum has swung too far toward extraction, and believe that conservative treatment over a period of time will show that many teeth which we now extract can and should be saved.

DR. M. J. HUBENY, Chicago (closing his part of the discussion): I think Dr. Gerber analyzed a much mooted point when he stated the limitations of the radiogram in acute mastoiditis. A parallel instance might be cited in an acute fulminating case of osteomyelitis of the tibia, clinically well defined, in which, numerous plates are taken and no information yielded.

It is unfortunate that considerable time must elapse between the onset of a disease process and its manifestations on the radiogram. This holds true in the entire domain of medicine, as usually, considerable time does elapse before obvious evidences of morbidity present themselves.

My deductions were derived from clinical experiences and since such important questions as, first, what is the nature of the infection; second, what is the degree of absorption, can not be predetermined, I firmly believe that more teeth will be extracted in the future than are extracted today and that the acceptance of the radiogram as a final arbiter of dental infection in a negative value will be discarded.

DR. B. C. DARLING, New York (closing his part of the discussion): I appreciate Dr. Tyler's discussion very much. The dentist is passing judgment on the patient's general health as to whether it will warrant his leaving any diseased condition and whether he should go on and treat the large periapical abscess. He is trying to practice medicine to bolster up his side of it. If we try to test the vitality of the teeth I believe we are doing things we ought not to do and trying to practice dentistry.



The Advantages of Using Dixon's Angle of Thirteen Degrees in Examining Accessory Sinuses and Mastoids

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SOON after Caldwell* read his paper on the examination of the accessory sinuses there came on the market a wedge-shaped "wooden pillow," based on Caldwell's work and made with a top sloping at an angle of 23° to the base. Pirie** described his method of utilizing this 23° wooden pillow for making mastoid examinations. This pillow has attained wide vogue in America in making examinations of the head.

Dixon conceived the idea of adopting an angle for examining the mastoid bone which would give a constant anatomical landmark, and he made a uniform practice of superimposing the shadow of the external auditory meatus upon that of the internal auditory meatus—the chief advantage of this being that these two shadows determine a vertical anatomical constant connecting these two meatuses from which comparative measurements can be made in each case to determine more accurately the amount of operative latitude there is and still avoid the lateral sinus and emissary veins, and also the nature and condition of the mastoid cells. A plate made at this angle shows the outlines of the ossicles of the ear in the middle of the concentric black circle of the external auditory meatus and the gray circle of the internal auditory meatus. This constitutes a striking landmark which is also exceedingly useful in determining whether the sinus is of the infantile type, whether it is "far forward" or not, as well as orienting emissary veins and determining the direction of the shadows to be encountered. When superimposing these shadows in the normal-shaped head Dixon finally adopted a pillow with its top inclined at an angle of 13° to the base. This "pillow" I carefully copied, but continued to use the 23° angle "pillow" for accessory sinus examinations until one day in a hurry I used the Dixon pillow for both accessory sinuses and

mastoids, and was surprised to find in the accessory sinus plates that the shadows of the petrous portions of the temporal bones were cast in the lower portion of the orbits, and the shadows of the antra and ethmoid cells were entirely clear of superimposed shadows of the petrous portion and appeared in continuity with the shadows of the ethmoids and frontals, thus eliminating all extraneous shadows of the petrous portion of the temporal bone from the field of the shadows of the accessory sinuses. So I have come to use one wooden pillow instead of two, because the shadows of the anatomical landmarks when the 13° pillow is used are superior for accessory sinus work as well as for the mastoid work for which it was originally devised by Dixon.

The technique is shown by illustrations (See Figs. 1, 2, 3, 4).

In an intensive surgical study of over three hundred sinus and mastoid cases at the Shurly Hospital in Detroit during the past six months, in which we were able to check up our x-ray examinations by thorough clinical, bacteriologic, pathological and surgical examinations, we have experienced material advantages in using this 13° angle pillow in all our accessory sinus and mastoid cases, as is shown in the accompanying roentgenograms.

The technique for examination of accessory sinuses is:—

In addition to the usual technique, the following details should be observed:

1. A lead kit with a round window is placed over the plate to avoid fogging from secondary rays.

2. The x-ray tube is accurately centered in the glass protective bowl.

3. A small cone is used in which the diaphragm opening above is just large enough to allow the direct x-rays to radiate to the periphery of the outlet of the cone; the outlet of the cone is round and conforms to the size of the window in the lead kit, and this is just large enough to give a circular radiograph including the shadows of the accessory sinuses.

4. Two exposures are made in the anteroposterior position, and one in the lateral—the first with the patient in the forehead-nose position on the 13° angle pillow; the second in the chin-nose position on the flat table; the third with the patient in the side-to-side position with the cone centered to show the depth of the portals and the sphenoid cell.

5. After exposure a lead-and-copper disc is accurately centered over the area on which the x-rays have acted; the usual lead numbers and letters are laid on the plate for orientation and for identification, and exposure made in order to put a background on the plate to aid the eye in studying the details of the shadows.



Figure I.—Position of Dixon "pillow," patient and tube in roentgenographing left mastoid region.



Figure II.—Dixon "pillow" as used by the author in roentgenographing the nasal accessory sinuses.

In making the mastoid exposures the following details are carried out:

1. Lead kits with round windows just large enough to include the mastoid area are used on top of the plates.

2. These plates are placed on top of the 13° angle wooden pillow.

3. The pinna of each ear is held forward by adhesive plaster.

4. Both mastoids are x-rayed on the same plate so that the posterior portions of the mastoid cells are in juxtaposition for easy comparison; that is, the shadow of the left mastoid is on the right end of the plate and the

shadow of the right mastoid is on the left end.

5. When making the left mastoid exposure the patient has the right hand above the head and the left hand at the side; when making the right mastoid, this position is reversed. This seemingly trivial detail is very important in order to have the shadows of the external and internal auditory meatuses superimposed.

6. The background of the plate is blocked out in the same manner as described for the sinus plate.

I use the ten (10) milliamper Coolidge tube, or a fine-focussed seasoned gas tube—and either plates or films with intensifying screens.

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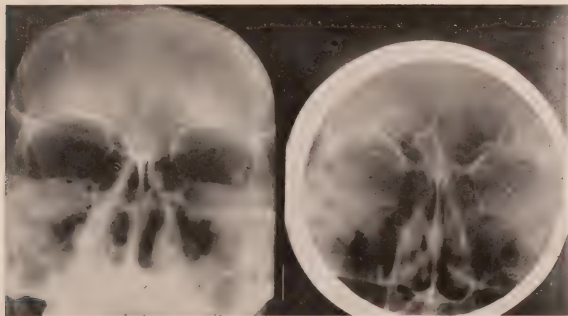


Figure III.—Roentgenogram of accessory sinuses at angle of 23° showing the shadow of the petrous portions of the temporal bones partially obscuring the shadows of the Antra.

Figure IV.—Roentgenogram of accessory sinuses at angle of 13° showing the shadow of the Antra unobstructed and in continuity with the Ethmoid shadows.

The Effect of Cellular Reaction Induced by X-Ray on the Fate of Cancer Grafts

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IT WAS demonstrated in this laboratory that x-ray given in proper dosage was capable of destroying the lymphoid tissue and circulating lymphocytes without inflicting any detectable damage on other tissues or organs. This observation was an extension of the work of Heineke, who showed that the lymphoid tissue suffered more damage after a large dose of x-ray than did other tissues or organs. This method of depletion of the lymphoid tissue gave us a means of determining the functional value of this tissue in various diseases. It was first shown that animals of tested immunity to inoculated cancer could be rendered susceptible by destruction of the lymphoid tissue and circulating lymphocytes. Likewise, natural immunity could be counteracted by the same means.

Further investigation showed that it is possible to induce a marked stimulation of the lymphoid organs and a lymphocytosis in the circulating blood by a properly regulated small dose of x-ray. Animals susceptible to inoculated cancer become highly immune after a treatment of this kind. Furthermore, animals with spontaneous cancers subjected to the stimulating dose of x-ray were rendered relatively immune to replants of their own cancers.

These observations led to a consideration of the part played by these manifestations in the results obtained by x-ray therapy. The point of first interest was to determine the effect of x-ray on the cancer cells in-vitro, eliminating the complicated effect of the rays on the animal body. A rapidly growing mouse cancer

was removed and divided into halves. One portion was exposed directly to x-rays in the following dose: Coolidge tube, spark gap eight inches, milliamperes five, distance six inches from target, time two minutes thirty-five seconds, without filters. The tumor was then divided into small bits and inoculated into a number of normal mice. At the same time the control half of the tumor was inoculated into a similar number of mice. After about five weeks one of the tumors arising from the x-rayed portion was removed and half of it exposed to x-rays in the same manner as above and reinoculated into another lot of normal mice. This procedure was repeated about every five weeks for seven months. The only effect of this treatment which is well above the therapeutic dosage.

was a transitory reduction in the growth energy and in the number of takes of the x-rayed tumor. Later in the experiment the x-rayed tumor grew as actively and gave as great a number of takes as did the untreated tumor, which was carried in parallel series.

A similar experiment with softer x-ray gave a like result. The dose used here was; spark gap one inch, milliampères twenty-five, distance eight inches, and time twenty minutes.

At this point in the investigation it became evident that either human cancers of certain types were more highly susceptible to x-rays than mouse cancers, or that there was some explanation other than the direct action of the rays on the cancer cell to explain the satisfactory results of x-ray therapy in human cancer. From an analysis of the results of x-ray treatment of human cancer, it is evident that the superficial growths are the only ones which respond with any degree of uniformity.

The following experiments were carried out to determine whether the location of the new growth was a factor in its response to x-ray and also whether

there was any evidence of an indirect action of the rays on the fate of the cancer cells.

Mice were given an erythema dose of x-rays over an area of the abdomen and histological examination made at intervals afterwards. This study confirmed earlier observations, namely that the erythema was preceded and accompanied by a lymphoid infiltration of the skin layers. This reaction, however, did not extend below the skin and the subcutaneous tissue was free from any cellular infiltration.

A large series of normal mice were shaved over the abdomen and a small area in the left groin was given an exposure of an erythema dose of x-rays. A cancer graft was then inoculated intracutaneously in the center of this area and a like graft was inoculated into the right groin, which had received no x-ray. The result was that practically none of the grafts grew in the x-rayed area, while most of the grew in the normal skin. This experiment was repeated in the same manner with the exception that the grafts instead of being inoculated into the skin were placed in the subcutaneous tissue. Under these conditions the tumors grew

equally as well in the x-rayed area as in the normal area.

We conclude, therefore, that the x-ray induces some change in the skin which renders it an unsuitable soil for the growth of cancer. This change is confined to the skin and is not present in the subcutaneous tissue. From our previous studies on the relation of the lymphoid cells to cancer resistance it seems reasonable to suggest the possibility that the lymphoid infiltration resulting from the x-ray treatment is the factor which renders the skin resistant to cancer growth.

The extent to which we are justified in assuming similarities or analogies between the behavior of tissues in man and in the lower forms of animals is a question which can be answered only by further and more extensive experimentation. However, with the evidence presented here, of a cancer which was not killed by a large dose of x-ray given *in-vitro*, but which will be rapidly absorbed if inoculated into skin which has previously been exposed to a comparatively small dose of x-rays, there is offered a point worthy of consideration in interpreting the results from x-ray therapy.



EDITORIAL

The JOURNAL OF RADIOLOGY

A Journal of Ideas and Ideals.

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Annual Meeting

"THE largest meeting ever held!" "The most interesting program!" and many similar expressions were heard from those in attendance at the annual meeting recently held in Chicago.

President Williams deserves the highest praise for his expeditious handling of the many problems presented. His genial smile and witty remarks at critical times put everyone in good humor. The president had the untiring and willing support of every member and officer present. Secretary Sandborn deserves special mention for his organization of the details of registration and his excellent choice of the reporter.

More than one thousand were in attendance, and sixty papers were given in a total session of forty-one hours. The scientific program was full of interest, inclusive, and came from wide sources. The purely physical aspect of deep therapy was presented by such men as William Duane, Ph. D., of Harvard University; Albert Bachem, Ph. D., of Frankfurt, a. M.; Dr. Guilleminot of Paris, Henry Schmitz, M. D., of Chicago, and Leo E. Pariseau, M. D., of Montreal.

This work is really the foundation upon which all radiation therapy rests. We think all present realized as they never had the necessity of sweating out the physical basis of deep therapy before building the superstructure of treatment. No two machines behave in exactly the same manner, each has to be standardized, and such facts carry conviction with them. The introduction of the more powerful apparatus for deep therapy

treatment brings the realization that cooperation is necessary. Too long have American physicians failed to work in close cooperation with physicists and laboratory workers.

Francis Carter Wood of New York, by showing the necessity of working out a biological method of estimating a standard dosage, coupled up the physical foundation with the clinical use of radiation. He has worked this out through experiment upon a certain strain of mouse cancer known as Crocker Fund No. 180. He selected this particular growth because repeated observations and tests carried through a period of four years have proven that this tumor is stable, that is, it does not spontaneously regress, but on the contrary, steadily advances ultimately killing the host. This type requires a fixed amount of irradiation to kill it, the amount being always the same. The dose, determined by actual clinical test on the human, is six times that required to produce a mild erythema on the skin of the chest or abdomen. Dr. Wood suggested the standardization of every deep therapy machine by the use of this strain of mouse cancer and courteously offered to supply the mice and instructions to any one wishing to make the test. The only condition of this offer is that complete reports be returned to him that he may have data on a large number of tests from widely disseminated sources.

From the pathological standpoint very valuable material was presented by A. S. Warthin, Ph. D., of the University of Michigan. This work is of extreme importance and sorely needed by radiologists because beyond any possible contradiction it proves the action of radiation on various tissues and pathological conditions. The doctor has spent much time and energy on the work thus far and has much yet to do. An exhaustive study has been made of the effects of irradiation on the skin-lymph glands, spleen and the thyroid. This work gives definite proof that the cells lose their identity and explode when irradiation is carried to the point of distinction and that they are later replaced by connective and fibrous tissue. The detailed description of this work will appear in The Journal soon.

We could go on and on, so much good material was presented, but we

must leave it until the papers themselves appear in The Journal.

The joint meeting with the Chicago Medical Society was unusually well attended. A white haired physician made the remark that he had attended the meetings of the Chicago Medical Society faithfully for twenty-five years and that this was the largest crowd he had ever seen. The auditorium in the Marshall-Field Annex Building was filled to capacity and two hundred stood up.

Dr. George E. Pfahler reported his "Results in the Treatment of Cancer of the Lip by Means of Electro-coagulation and Radiation" and showed sixty-five cases well more than five years.

Dr. Russell D. Carman talked about "Errors in the Roentgen Diagnosis of Duodenal Ulcer." He reported 523 cases all submitted to operation, in 520 of which a correct ante-operation diagnosis had been made. Dr. Sippey in his discussion reported that his experience had not led him to think the roentgen diagnosis so accurate as Dr. Carman had stated. It was brought out that the term "peptic ulcer," as employed by Dr. Sippey, was incorrect, as it does not distinguish between the gastric and the duodenal types. Considerable merriment was produced during the discussion by a jovial criticism from Dr. Lewis Gregory Cole, in which he asked Dr. Sippey if he would not feel very happy had he 520 diagnoses out of a possible 523 proven correct at operation.

We want to mention the banquet because of certain events which occurred there. Some idea of the extent of the program can be given by the fact that Dr. Williams had secured sixteen different men to give after dinner talks, and some idea of its character is shown by the fact that the evening passed very quickly.

After brief remarks by the honor men and the president's annual address, Mr. A. P. Johnson, editor of the Grand Rapids News, made an address upon the subject "The Danger Point in Civilization," emphasizing the fact that over-specialization has produced a lack of cooperation and that we should now help the pendulum to swing back the other way.

Following Mr. Johnson came F. C. Warnshuis, M. D., speaker of the House of Delegates of the American

Medical Association, whose subject was "Ideals to be Sought." He pleaded that individual units of the medical profession work out their own problems through coöperation rather than having outside influences solve their problems for them.

Franklin H. Martin, Secretary of the American College of Surgeons, spoke further about the value of coöperation in medicine and pledged the support of the College of Surgeons to help radiologists solve their problem.

Frank Smithies, M. D., Secretary of the American College of Physicians, went one better by saying that the College of Physicians was already coöperating with the radiologists. We are very happy to claim Dr. Smithies as one of the early members of the Radiological Society, thus giving double proof of his statement.

A. J. Pacini, M. D., formerly Chief of the X-ray section of the U. S. Public Health Service; Russell D. Carman, M. D., head of the Section of Roentgenology, Mayo Clinic, and Albert Soiland, M. D., President-elect, all made brief remarks along the same trend.

The commercial exhibit was large, occupying the entire mezzanine floor as well as a large room across the entire north end. There were thirty exhibitors in all. There was the usual exhibition of diagnostic equipment of all kinds attracting much attention. The greatest interest, however, was manifested in the deep therapy equipment, of which three types were shown, one where a large size single transformer made up the power plant, another where two ten inch transformers were connected in series, and a third where a single transformer was employed and the rectification was made through the neutral leg of the transformer.

This report would not be complete if it did not mention the fact that two hundred and fifty new members were received, giving the Radiological Society of North America a total membership of approximately seven hundred.

The annual meeting in 1922 will be held at Detroit, Michigan, the first week in December. Exact dates will be announced later.

Research Bureau

ONE of the important actions taken by the society was the establishment of a Research Bureau. A committee was appointed to work out the details for the proper functioning of this Bureau. It is not yet known just how the work will be carried on, as sufficient time has not elapsed to per-

mit the formation of a complete plan. We can see several angles of approach, however.

Much research of extreme value to radiologists is now being carried on throughout America. This work as carried on falls into three general groups, viz.: that which is being done by institutions founded and maintained for research work exclusively, illustrated by The Crocker Institute, The Rockefeller Institute and others; second, the research work carried on under support offered by the various universities, such as the work of William Duane at Harvard University, William F. Peterson at the University of Illinois, Professor Ivy at Loyola University, Leonard Loeb at Chicago University, A. S. Warthin at the University of Michigan, H. E. Robertson at the University of Minnesota, and others which do not now come to mind; the third group is composed of those active clinical radiologists who are interested in some problem directly connected with their work, but who must work alone, such men as Henry Schmitz of Chicago, Robert Milwee of Dallas, and Arthur Erskine of Cedar Rapids illustrate this group. Besides these three groups there is the work of the National Research Council and the United States Bureau of Standards, which undoubtedly could furnish much valuable material to the radiologist.

It is hoped that all these agencies can work in a coöperative way to make their work available to those interested. The society should be able to act as a clearing house of information between the research worker and the clinician.

Social Medicine

DR. FRANK BILLINGS of Chicago made fervid appeal to the members of the Douglas County Medical Society at Omaha, Nebraska, the evening of December 13th last, to adopt what he proposed as a constructive program, and which he said, if followed through, would certainly stop all loose talk about the socialization of medicine.

The program which he argued was worthy the serious consideration and the whole-hearted support of the entire medical profession, both through the American Medical Association and the various local societies of medical men scattered broadcast throughout the United States, contemplates that the medical profession shall procure the introduction into, and passage by, every state legislature of an enabling act. That act, it is contended, should be so drawn as

to give the people power to tax themselves for the erection of hospitals in any political subdivision (hamlet, town, county or city ward), and for the purchase of laboratory and other diagnostic and therapeutic instruments and supplies. This would have the effect, according to Dr. Billings, of "medicizing socialization," an expression which must be condemned as being both extremely naive and nebulous.

Viewed from the sociological side as well as the professional side, such a proposition needs very careful analysis and critical study. There can be, of course, no question about the right of the people to exercise this function of the police power of the state if they so choose. But such a method of meeting the issue now confronting the public and the profession, i. e., safeguarding the public health, is one that may well be considered at length in order that we may not all find ourselves in a sorry dilemma later, a dilemma from which it may be exceedingly difficult to extricate ourselves physically, financially, governmentally and morally. If we are to profit at all by the experience of the British public with its panel system of medical practice, or the paternalistic pauperization that has characterized governmental medicine in Germany, or even some of our own experiences in other phases of the socio-economic problem, there is certainly grave question whether the plan proposed offers any real, substantial benefit for the improvement of the present failures of our medical functioning. In any event, it smacks altogether too much of Marxian philosophy to be accepted *per se* either as an irreducible minimum guaranteeing the public health, or as a *quid pro quo* to offset the insistent demand of the general public for a more intelligent and accessible medical service.

More than this, it is our own notion that neither the medical profession nor the general public can afford to approach this problem in a controversial spirit or in the attitude of either trying to put something over on the other.

Wherefore, we make bold to say, that if the medical profession adopts this proposal and requires the lay public, through taxation, to provide the working tools of medical ministrations, it must be prepared to eat the other and bitter half of the apple, and accord that public the inalienable right to prescribe the conditions under which those working tools shall be used, and the fees which the medical profession using them charges back

to the public in conjunction with their use. That is elementary. Our educational system, the United States Postal Department, and our other governmental agencies are cases in point. The established principles of public policy guarantee this safeguard to the tax paying public.

Anything less than this, any other interpretation of the law, would be in absolute contravention of those constitutional guaranties and inviolable principles on which our government and social institutions rest. To apply any other rule to the medical profession for the purpose of differentiating it from all other socio-economic units would most assuredly open the door to the carpenter, the engineer, the mechanic, the butcher, the baker, and the candlestick maker to demand the application of the same principle in their respective cases, and to insist that the public lay taxes on the wealth and life of the community for the purpose of providing each and all of them with the necessary housing facilities and implements for their particular socio-economic functions. Otherwise, those constitutional guaranties written into the supporting structure of our social and governmental fabric with the sweat and blood of our forebears, would become contemptible scraps of paper. So it is, that such a proposal, consciously or unconsciously, is a plea for class legislation, fathered in bigotry, mothered in iniquity, and conceived in social intolerance.

Dr. Billings is recognized as one of the leading spirits of the American Medical Association. To him is gladly accorded the honor which goes with the deanship of medical opinion. We would not detract a single jot or tittle from either. But we must insist that Dr. Billings has not thought his proposition through to its logical and inevitable conclusion, despite all protestations to the contrary. Being honest with ourselves, however, requires that we perform the unpleasant task of taking issue with Dr. Billings and calling his attention to the indisputable fact that, in making this sort of a proposal, he is, in fact, advocating the rankest kind of state medicine. Certainly, when a number of such institutions as he proposes have been established it will be necessary to co-ordinate them and govern them, and being publicly or governmentally owned institutions, the logical place for the lodgment of that responsibility would be in the department of public health.

Brushing aside all these fundamental problems, such a proposal is at

least an admittance, willy nilly, by a high priest in the greatest organization of medical men on the face of the earth, that medical men as such are not able to stand on their own feet. It is a sweeping denial of all the preachments of self-sufficiency and human service which have been the shibboleth of the medical profession since time immemorial. It is a public confession that the ideals and purposes of the medical profession are inherently so far flung that the medical profession is unable to apply them practically to a human living world and make them minister to a man's man in a man's fashion.

Enough of this. Fundamentally, the weakness of Dr. Billings' position lies in the fact that he, like many other medical literateurs, has constructed the warp and woof of his vision of the future of the medical science on the restricted notion that preventive medicine, or the question of public health, means nothing more than the exercise of the police power of the state for the protection of its citizens against the overt act of any individual citizen infected with or exposed to communicable disease.

This is the point where we diverge. Preventive medicine means infinitely more than that or it is utterly fallacious and holds no promise of future stability or large social purpose for the medical profession. Preventive medicine must mean more than that, or the public can pin no faith on the science of medicine as a socio-economic agency in the intelligent up-building of the public health.

Preventive medicine must mean the science of correct living imparted to the general public in such a manner that that public will know how to safeguard and preserve its ability to do a day's work. Nothing less than that conception will measure up to the standards of the medical profession or the confidence reposed in medical science by men and women who have the will to work, the ambition to achieve, and the desire to create.

Others hold somewhat parallel views. Dr. Boyd, professor of bacteriology and preventive medicine for the University of Texas, says:

"Preventive medicine may be defined as that branch of applied biology which seeks to reduce or eradicate disease by removing or altering the responsible etiological factors. * * * Included within its scope are hygiene and sanitation."

Dr. Dorland, a member of the committee on Nomenclature of the American Medical Association, defines preventive medicine as:

"That branch of study and practice which aims at the prevention of disease."

These definitions might be multiplied indefinitely, but that would simply be a cumulative effort. Those quoted suffice to prove that preventive medicine has a larger scope than that comprehended by Dr. Billings' plan, or possible of accomplishment by the exercise of the police power of the state, and refute finally, emphatically, and once for all, any assumption that the public health can be made subservient to, or wholly dependent upon any scheme or plan which functions through the police power of any political unit or group of political units.

We have no desire to quarrel with Dr. Billings. On the contrary, it is our earnest hope that this discussion will help to clarify his thoughts, and that in return he will help us to set down in orderly fashion the enormous mass of confused ideas which are bothering us.

To this end, it seems well here and now to suggest that whatever functions the police power of the state enjoys, or may be made to include by future legislative enactments, are incidental to the larger purpose of the medical profession. This brings us to an apparent point of agreement with Dr. Billings, to-wit: that what the medical profession needs now more than anything else, is a social concept of medical practice. Where Dr. Billings' views and our own are diametrically opposed is on the question of method by which that social concept can be created and made to function intelligently for the public good. Though even Dr. Billings leans pretty heavily in our direction, as evidenced by his oft-repeated statement that the medical schools of the present day are not adjusting medical students in such a way as to fit them for the performance of their professional duties toward the public; and further, by his assertion that the medical profession cannot shift the responsibility for these problems to the public, but must do something on its own account.

Speaking broadly, there are two phases of this part of the subject under discussion which must be made to harmonize in purpose although it may not always be possible to make the successive stages of their development coeval. These are, first, the attitude of the medical profession toward, and its knowledge of, the socio-economic requirements which any organic health program must meet; and second, the measure of voluntary public confidence which can be called

into existence in support of an organized effort to achieve a better public health as a social asset.

In this connection, we are constantly reminded of the wisdom of that Biblical teaching, "Come, and let us reason together." For it must be conceded by all right-minded and thoughtful persons that it is the sheerest kind of nonsense to expect the medical profession to lay down anything like an inclusive or conclusive health program without taking into account all the etiological factors which produce abnormal and unhealthful biological results. By the same token, it is also the sheerest kind of nonsense to expect the lay public to understand and avoid these results unless they are first fully informed concerning the etiology behind them.

More than all this, the general public, as distinguished from the medical profession, is not going to blindly submit to any universal or sweeping reformation of its intimate and personal habits without good cause. Or, stated conversely, the public will insist upon demonstrable and satisfactory evidence of both the feasibility and practicability of any program which strikes at or seeks to elevate the standards of public health.

That is why the proponents of state medicine or social medicine, speaking now of the governmental practice of medicine in whatever form it is proposed or by whatever name it may be called, are so irresistibly funny. They argue that a thorough-going public health can only be achieved by the calendar of governmental power. They seem to have fallen into this specious conclusion as a result of military medicine during the late world convulsion, when the medical staff was able to prescribe hours of work, conditions of housing, dietary measures, prophylactic treatment,

vaccination, inoculation, and the Lord only knows how many other restrictions, specifications, and mathematical calculations—all injected into every man's daily routine by the exercise of all the latent energies of a war mad world intent on crushing supermen by the development of greater supermen.

So far as peace-time government is concerned, however, that sort of a scheme is a pure Marxian sophism. It is impossible to escape, though the ardent advocates of state or social medicine always try to dodge, the part the individual man, woman and child must play in any serious effort to improve social standards whether they relate to health or any other specific phase of our existence. That is why it is absolutely impossible to accomplish a universal knowledge of, and obedience to, the science of health by a mere twig of the thumb of the police power of the state. Compulsory rules of conduct, even though they include both the profession and the public, will not, if we understand the principles of American sovereignty, beget a wholesome respect for medical science, but rather will reduce it to the political and social pooh bah state, a thing perhaps to be tolerated as a necessary evil, but never accorded that mass individual support which always characterizes a common cause for a common purpose grounded in intelligence and mutual understanding.

To say, or even to assume, that the nation, whether speaking individually or collectively, can be purged of all its unscientific, inhuman, and unhealthful purposes (concerning many of which the medical profession itself does not now possess specific knowledge either preventively or curatively) by or through the exercise of the

police power, is neither warranted by fact, nor justified by the most Utopian dream of the future development of the human race. Men and women are not likely to be re-made over night by a copious physis of health propaganda administered by the medical profession or any other group through the police power.

As we see it, the immediate problem which confronts the medical profession as well as the general public, is a reconstitution of medical practice in order that it may conform to the socio-economic needs, and in order that the medical profession may be enabled to come before the public with clean hands when it asks the support of the public for any program it may have mapped out. Such a reconstitution must of necessity be based on an earnest effort to comprehend the medical profession's job as a socio-economic unit charged with full responsibility concerning the public health, and must call for the intelligent use of the great multitude of agencies already in existence before the public shall be asked to add to the tax budget the cost of others.

The incident which is the subject of this discussion emphasizes and furnishes irrefutable proof of the fact that the medical profession is not now paying the price in mental stress which insures the correct interpretation of the most important phase of development in the history of medical science. It must pay that price or suffer the consequences. It is to the performance of that individual responsibility resting on the medical profession that this discussion is directed. It is to that goal our eyes must turn for the answer to this great question. The ultimate objective of the medical profession can never be attained in any other way.



DEPARTMENT of TECHNIQUE

Protecting the Patient During Prolonged X-Ray Treatment

Charles Goosmann, M. D.

Cincinnati, Ohio

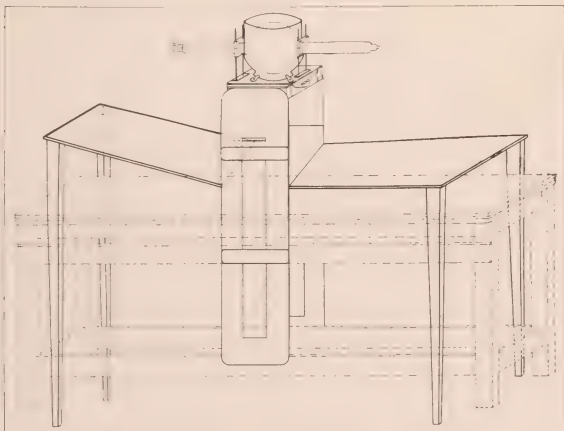
IN giving treatments with the new high voltage technique, I have found it difficult to protect the patient adequately. The heavy covers of leaded rubber are very uncomfortable for prolonged treatments. It has, therefore, seemed necessary to make special provision for this.

As a preliminary trial, I have placed some boards over the patient, the supports for the boards being high enough to prevent touching the patient's body. Any amount of protective material can then be placed on the boards. This has seemed so satisfactory that I am having two tables made for this purpose. Each table will have sufficient width and height to permit it to be moved over the treatment table, after the patient is in position. One of these tables will be shorter than the other, and will have a tilting arrangement, which gives ample space above the patient's head, lessening the fear of nervous individuals.

The accompanying figure illustrates the principle. The treatment table (which has a lead lining on the under surface) is shown in dotted lines; the tube holder and protective table in

heavy lines. The illustration is incorrect in giving the impression that the tube holder and protective tables are permanently connected. It is more convenient to have the two protective tables separate, so that they can be adjusted for the treatment of different regions.

After covering the accessory tables with metallic lead, I will use leaded rubber to hang over the edges, so that the patient will be enclosed in a tunnel. Besides the protection from x-rays, this device will lessen the possibility of accidental contact with the high voltage current.



NEW EQUIPMENT

The New Wappler Deep Therapy Machine

DURING the earlier days of x-ray therapy of deep seated malignant growths, the calculations of dosage and of the most effective voltage were based on the classical absorption law of homogeneous radiations. On the basis of this law the most desirable tube voltage for the effective treatment of deep seated lesions would be calculated to be between 80,000 and 100,000 volts. It is assumed that a more deeply penetrating radiation would not be sufficiently absorbed to

be effective, while a radiation which is more readily absorbed may be too injurious to the skin before any effect in the deep is obtained.

Clinical results, however, which recently became available, indicate that much better effects in destroying or inhibiting cancerous growths are obtained when considerably higher voltages are applied to the tube. This apparent conflict, however, was promptly removed when by physical measurement, it was found that the scatter-

ing effect of the highly penetrating radiations is primarily responsible for the destructive effect within the tissue. It was determined that from 60 to 80 per cent of the effectiveness of highly penetrating rays in the depth of the body are due to the scattering of the primary rays; and thus the physical measurements are again brought into accord with clinical observations. It therefore seems definitely established at the present day that the very highly penetrating

rays are much better adapted for administering a destructive dose to a deep seated growth, than the rays of comparatively lower penetrative power formerly employed. As soon as this fact was definitely established, new types of x-ray tubes came into the field which are capable of operating with potentials of from 200,000 to 250,000 volts.

The final topic in this problem now is the construction of x-ray apparatus which will produce and rectify a high voltage current up to 300,000 volts, and which is of such construction that it can be run continuously for the long periods of time required for the new method of deep therapy.

The difficulties in generating and rectifying high tension current up to 120,000 volts are too well known to require special mention. Therefore, in order to create voltages which are over twice as high, it would seem impossible to find a solution with the older method.

The Deep Therapy machine of the Wappler Electric Co. is distinctly novel in that it consists practically of two machines connected in series. The two transformers, each of which generates about 150,000 volts are connected in series. The double rectifying mechanism is arranged so that two separate rectifiers rectify independently the current produced in each of the two transformers. The maximum voltage of 300,000 volts which could be applied to the tube, therefore, consists of 150,000 volts negative potential developed in one transformer and applied to the cathode, and 150,000 volts positive potential produced in the second transformer and applied to the anode of the tube. The problem of generating these excessively high voltages is therefore simplified by using the regular well tried type of transformer and connecting two of them in the above described manner.

By decreasing the surface area of the rectifying discs and mounting the discs on insulated hubs, it is possible to drive both rectifying mechanisms with one regular synchronous motor of the size used for the Bellevue machine. The mechanical noise and the air blast produced by this rectifying mechanism are negligible. The size of the deep therapy machine is 38 inches wide, 61 inches long, and 67 inches high.

Another difficulty in connection with this problem is to avoid surges and oscillations in the high tension circuit. Their presence is ordinarily indicated by a distinct flickering of

the tube and extensive corona effects along the connecting wires where a distinct humming noise and a large amount of ozone is produced. These harmful effects are eliminated through the use of special grounding resistances which are distributed in the secondary circuit so that the formation of oscillations is prevented. The effects of these resistances in the secondary circuit are brought into evidence by the steady quiet running of the tube and can be demonstrated with a rotating vacuum Glowler tube connected in series with the tube. With a properly corrected secondary circuit it is possible to run the deep therapy Coolidge tube continuously with 5—8 milliamperes at 280,000 v. peak value without any signs of strain or flickering in the system. Various observers have remarked that it hardly seems possible that the tube is operating at such high voltage and they expressed great surprise when the current actually jumped a gap of 18 inches, between the usual spark gap points in air.

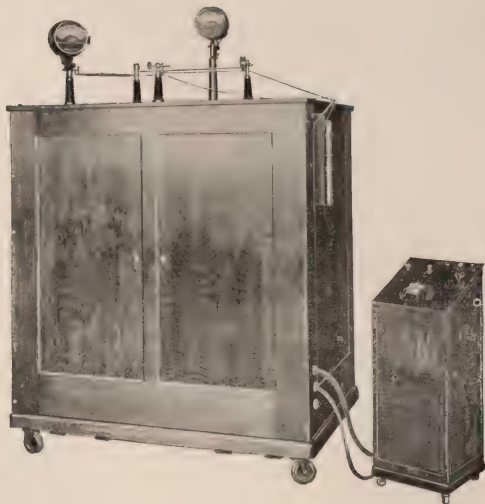
The Wappler Deep Therapy Machine is now in actual use in several clinics and during the entire day develops and maintains with absolute constancy, currents of the above description. A valuable factor which produces constancy is the Wappler stabilizer, which is embodied in this machine and through which not only the milliamperage reading, but also the high tension voltage is kept surprisingly constant. The method adopted in the Wappler Deep Therapy Machine of generating and rectifying

high voltage currents appears to be the most logical, and actual experience with this machine in the deep therapy laboratory has proven that this method is undoubtedly the most satisfactory and dependable in actual performance.

Kelley-Koett Magnetic Devices For Tubestand Control in Stereoscopic Work

REALIZING the inconvenience of strings in order to accomplish the necessary releasing of plates and tube stands in doing stereoscopic chest work, the Kelley-Koett Mfg. Company has designed magnetic devices for this purpose. This is a great improvement for this class of work, as the necessary shifting can be accomplished by means of simply pushing a button. This makes it possible to get an instantaneous shift of both tube and plates. It does away with the necessity of having a technician assist in this work. The entire procedure can be done by the operator alone, both shifting and exposure.

This product has been heralded by many of the roentgenologists as an absolute necessity. It can be very conveniently installed by any one. If the tube stand in your office was purchased from the Kelley-Koett Company more than two years ago, it will be necessary to add to the pump shifter of the tube stand the improved release mechanism.



CASE REPORTS

Sarcoma of the Mediastinum, C. H. DeWitt, M. D. Valparaíso, Indiana

ON January 18, 1921, Mr. R. B. L., a patient of C. O. Wiltfong, M. D., was referred to me for a roentgen examination of the chest.

The clinical findings were those of a marked increase in intra-thoracic pressure as evidenced by marked dyspnoea, a sense of fulness in the upper half of the chest, marked dilatation of the superficial veins of the

chest, and the thoraco-epigastric veins, marked edema of the neck and left side of the face, left ear enlarged and cyanotic.

Personal and family history of no importance. He was not able to date definitely the onset of the trouble, but he had had a feeling of distress for some months. He coughed some and raised some mucus.

Physical examination of the chest revealed a downward displacement of the heart toward the left side. A marked area of dullness extended from the episternal notch to the base of the heart, and laterally to the nipple lines.

Blood, urine and sputum examinations were negative.

Roentgen examination: The fluoroscope revealed a tumor filling the upper median portion of the chest, its density being about equal to that of the heart. The tumor was very sharply outlined along its right margin, not so definitely on the left, and pulsation was detected in the left margin of the mass. Figure 1 shows the condition at this time.

I made a tentative diagnosis of aneurism of the arcus aortae with thrombus formation, and although the history was entirely negative, suggested a Wassermann. We secured one report of + + + and four frank negatives from four other laboratories.

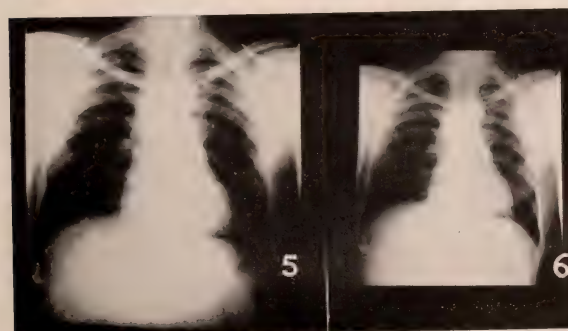
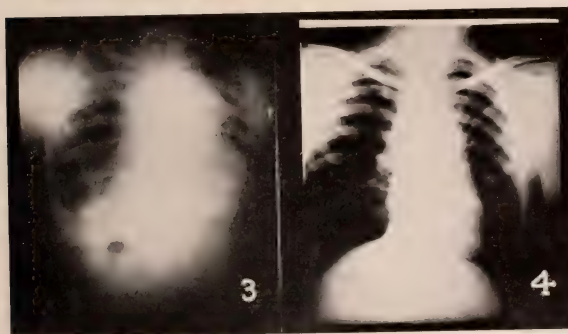
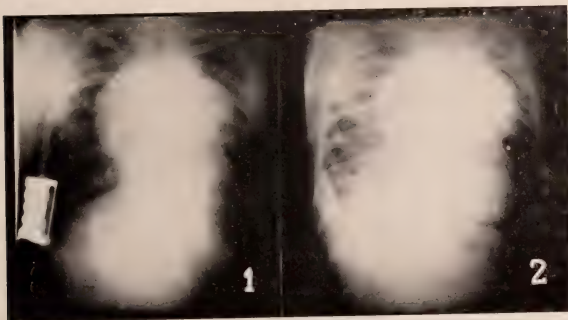
The patient consulted a number of specialists in Chicago and in the east without securing a definite diagnosis, or any encouragement as to relief.

He returned to me on February 15, and Figure 2 shows the condition on that date. We now felt sure that we were dealing with mediastinal neoplasm and not an aneurism, and, deciding that roentgen therapy might be of service, I gave the initial treatment on February 19th. His physical condition was such that I did not feel justified in giving a massive dose, and used the following technique for the first four treatments: seven and one-half inch spark gap, four mm aluminum and one-fourth inch sole leather as a filter, ten inch target-skin distance, ninety-five kilovolts, five mm current for twenty minutes. Used four ports of entry, anterior, posterior, and right and left lateral. Treated one area each day. For subsequent treatments I used the same technique, except that one-half mm copper and one mm aluminum was used as a filter, increasing the time proportionately.

Clinical improvement was noted on the fourth day, and from February 19 to April 7, eighteen milliampere hours were given. Figures 3, 4 and 5 show the retrogression of the tumor. Figure 3 was taken March 1st; Figure 4, March 20th; Figure 5, March 30th; Figure 6, taken on May 6th, shows the final result. He has had two treatments since May 6th.

The patient is now clinically well and shows no x-ray evidence of chest pathology. He has gained twenty-two pounds in weight, says he never felt better, and works every day.

While we are unable to make a positive diagnosis as to the pathology in this case, we feel that it is of sufficient interest to report in the Journal. My opinion is that it was a sarcoma, or a lymphosarcoma.



ABSTRACTS and REVIEWS

Further Observations in Roentgenotherapy of the Chest. By W. Walter Wasson, M. D., and Clinical Observations on Roentgenotherapy of the Chest. By James J. Waring, M. D., Denver. *Journal of Radiology*, January, 1922.

THIS paper describes additional points in technique following observations presented by the author at the annual meeting, 1920.

Fluoroscopic examination reveals the lung adjacent to the heart area with each systole—in diastole it moves away. The movement is transmitted plainly for two or three inches in a wide area around the heart, and less plainly for a still greater distance. This is especially true if disease is or has been present. The time consumes not over one-half second for each movement.

Also in the one-half second during systole one of the bronchi near the heart moves approximately one-half its width toward the heart.

Further observation reveals minute tubercles and other localized areas of disease traversing similar paths to the bronchi. Movement from the auricle is rather imperceptible, from the aorta and great vessels it is quite evident and opposite in time to the ventricle movement. No movement is seen in the peripheral fields, but post mortem reveals here a jelly-like mass which must respond to vibration.

All this is involuntarily movement except that of dyspneic patients and children, and at times the vibration from apparatus.

In chest roentgenography the time must be one-tenth second or less, which is very practical with proper balancing of voltage and milliamperes. The tube must be stable enough to give the desired current at the proper time. The size of the focal spot of the tube indicates ability to focus rays upon a certain density.

A fine point of focus will focus an object five inches from the plate when the anode is twenty-eight inches from the plate. A broad focus tube would need to be nearly forty inches from the plate to sharply outline this same object. A greater distance means loss in power and quality of the rays, therefore longer exposure, more current and a greater strain upon the tube. Chest measurements were begun to find a way to overcome this vicious circle.

The problem was found to be to bring a lung measuring eight inches at its furthest point from the film into sharp relief on the finished film. Even with the sharpest focus tube obtainable there is still two inches of the average posterior lung out of focus. This rather than the amount of tissue is taken by the author to be the reason of the blurring of the film in the case of thick people. Stereoscopic plates aid in seeing the anterior and posterior parts of the lung.

To increase the distance too far at the expense of the time factor is inadvisable. The majority of cases can be covered with very fine tubes at a distance of twenty-nine to thirty inches and the larger chests may be taken on their backs to study the posterior lung fields. This will permit work at one-tenth second or less with no unusual wear upon the tube.

The hilus and portions of the mediastinum show any fibrous or glandular change without confluence of shadows. Study then can be made of any infiltration of hilus blands and spread of infiltration to the adjacent lung.

The bronchial walls and adjacent lymphatics and vessels may be studied. In peri-bronchial thickening in tuberculosis the bronchi show the characteristic sharp, fibrous, beaded outline. In the purulent form of bronchitis the walls are thickened, in the chronic form they are not only thickened, but have fuzzy, fuzzy outlines. This is also the case in the bronchiectatic form with the addition of localized pockets and dilations in the bronchial lumina. This makes possible an early diagnosis.

Even in the normal lung a very clear view is shown of the bronchioles. It is possible to study any change from the normal. The first change is a broadening of the shadows, with perhaps some beading in the meshes which may extend to the hilus. In the next stage the small beading is more confluent until there is a patch indicating air cell congestion. This is to the roentgenologist what the rale is to the internist. The description is characteristic of some chronic infections rather than very acute ones.

To state that there is interweaving of the terminal bronchi is insufficient as this may come as an extension from the hilum in bronchiectasis. There are similar processes to be differentiated in cardiac disease, dust and chemical inhalation.

Dr. Waring was asked to summarize the internist's viewpoint, which he gave as follows:

It is the wise physician who refuses an opinion, in doubtful cases, without the aid of stereoscopic plates.

The greatest usefulness of the x-ray in diagnosis of pleuro-pulmonary affections lies in the differentiation of borderline conditions.

A tolerably good film of the lungs is worth no more than a tolerably good physical examination. In even the best plates interpretation is difficult, at times impossible. Poor plates lacking definition, not large enough to include the whole chest, not made in the briefest time are worse than useless for wrong conclusions will be drawn. Two cases are cited in the original communication illustrating this point.

The physician needs to be able to interpret his own plates so as not to follow blindly his colleague's opinion—by this is not meant that he should

rely solely on his own opinion. A good plate is never in error.

Dr. Waring has found the x-ray most helpful in the following groups of cases:

1. In the diagnosis of frank pulmonary disease to assist in the determination of its tuberculous or non-tuberculous nature.
2. In the diagnosis of suspected pulmonary disease.
3. In manifest tuberculosis to determine its location and distribution and to assist in arriving at a prognosis, and as a general guide in handling the case.
4. In diagnosis of certain pulmonary complications, e. g., pneumothorax, effusion.
5. As a routine preliminary to artificial pneumo-thorax and in the subsequent care of these cases.

The Effect of Cellular Reaction Induced by X-Ray on the Fate of Cancer Grafts. By James B. Murphy, M. D., and Raymond G. Hussey, M. D. From the Rockefeller Institute of Medical Research. *Journal of Radiology*, January, 1922.

X-RAY in proper dosage in this laboratory was demonstrated to be capable of destroying lymphoid tissue and circulating lymphocytes without damage to the other tissues.

Natural immunity and immunity to inoculated cancer in animals was overcome by destruction of lymphoid tissue and circulating lymphocytes.

Animals susceptible and those with spontaneous cancer became immune to inoculated cancer after a properly regulated dose of x-ray which stimulated the lymphoid organs and produced lymphocytosis in the circulating blood.

To determine the effect of x-rays on cancer cells in-vitro a rapidly growing mouse cancer was used to inoculate a series of mice. One-half of this cancer was first treated with x-ray, the other half used as a control.

The final conclusion reached from these experiments was that either human cancers of certain types are more susceptible to x-rays or else that there is some other explanation than direct action of the rays on cancer cells to account for the satisfactory results of x-ray therapy. Superficial growths are the only ones that respond with any degree of uniformity in the x-ray treatment of human cancer.

Further experiment with mice led to the conclusion that x-ray produces some change in the skin which renders it unsuitable soil for the growth of cancer. This change is confined to the skin and is not present in the subcutaneous tissue. From previous studies of the authors it seems reasonable to suggest the possibility that the lymphoid infiltration resulting from the x-ray treatment is the factor which renders the skin resistant to cancer growth.

Further and more extensive experimentation is required before data secured by experimentation with lower forms of animals can be used as a basis from which to draw conclusions in regard to the human, but with the evidence presented here of cancer which was not killed by a large dose of x-ray given in-vitro, but which was rapidly absorbed when inoculated into skin previously exposed to a comparatively small dose of x-ray there is offered a point worthy of consideration in interpreting the results from x-ray therapy.

Homogeneous Radiation of the Chest.

By Arthur W. Erskine, M. D. Journal of Radiology, January, 1922.

THERE are cases of cancer of the breast which recur after retrogression of growth and general systemic improvement have taken place, the patient finally dying from recurrence, or from extension of the disease into the mediastinum or lung.

Since a sufficient amount of x-ray caused the disappearance of the growth it is probably proper to assume that if all the mediastinal glands and all parts of the lung received approximately the same dose as the growths underneath the skin progress of the disease would be completely stayed.

Radiation of the chest then is desirable and the problem is to determine the combination of anode skin distance, size, and number of fields, voltage and filters to produce the most homogeneous radiation.

The average surface depth distance in one hundred cases of women was found to be four centimeters.

The size of the fields and the anode distance must be considered together. A full depth dose is possible by radiating the chest through many small fields, which has however the following disadvantages—the center of the field is the base of a pyramid of tissue which receives progressively smaller percentage of the skin dose as depth increases; the corner of a field where it adjoins the three adjacent fields is the apex of a pyramid which a short distance under the skin receives almost four times the skin dose; there is danger of overlapping areas and of leaving untreated strips of surface between areas.

If, in treating four areas, instead of exposing each one ten minutes at a distance of eight centimeters they are all exposed forty minutes at a distance of sixteen centimeters the skin dose will be the same, also the total amount of radiation received by the body. This will be more evenly distributed and there will be a substantial drop in surface depth ratio. Data of Friederich and Kroenig show that there is a further increase in the depth dose when large fields are used and the author's experience corroborates this.

Trial shows the proper anode-skin distance to be sixteen centimeters which will radiate a circle ten centimeters in diameter.

Exposure of the half chest is made in four planes.

The problem now is to find the combination of voltage and filters that will deliver at least one-fourth of the surface dose to the center of the chest so that the sum of the four

depth doses will equal one skin unit.

A crude electroscope was constructed to determine relative measurements of intensity.

By experimentation with a phantom with the same absorption value as the living chest the conclusion was drawn that at least one hundred kilovolts should be used and that the rays should be filtered through ten millimeters of aluminum or one-half millimeter of copper.

The author's thanks are expressed to Prof. L. B. Loeb of Chicago University and to Prof. L. D. Weld of Coe College, who offered helpful suggestions as to the measuring apparatus, and to Mr. Edward M. Smith for assistance in taking the readings and arranging the data.

The Advantages of Using Dixon's

Angle of Thirteen Degrees in Examining Accessory Sinuses and Mastoids. By Arthur F. Holding, M. D. Journal of Radiology, January, 1922.

THE author had been using the pillow adopted by Dixon, with its top inclined at an angle of thirteen degrees to the base, for mastoid examinations and had continued to use the twenty-degree angle pillow for accessory sinus examinations until one day when in a hurry, he used the Dixon pillow for both and was surprised to find in the accessory sinus plates that the shadows of the petrous portions of the temporal bones were cast in the lower border of the orbits, and the shadows of the antra and ethmoid cells were entirely clear of superimposed shadows of the petrous portion and appeared in continuity with the shadows of the ethmoids and frontals, thus eliminating all extraneous shadows of the petrous portion of the temporal bone from the field of shadows of the accessory sinuses. The pillow is superior for accessory sinus work as well as for the mastoid work for which it was originally devised by Dixon.

The technique is shown by illustrations as well as described in the original article.

In an intensive surgical study of over three hundred sinus and mastoid cases at the Shurly Hospital in Detroit material advantages were experienced from using this thirteen degree pillow in all accessory sinus and mastoid cases.

Dermoid Cysts in the Thorax, with a Review of the Literature. By Ichn T. Murphy, M. D. F. A. C. P. Journal of Radiology, January, 1922

DR. MURPHY gives a detailed history of a case of tumor mass in the upper chest, evidently connected with the mediastinum. The patient was a girl of thirteen years.

Diagnosis was: Tumor of the lung—probably a dermoid—with involvement of the cervical cord, caused either by direct pressure or metastasis.

No evidence of rupture of the tumor was seen at any time and the patient experienced but little pain during the entire course of the disease. Confirmation of the diagnosis was not possible because post mortem was refused.

Review of the literature on dermoid cyst in the thorax gave a history of one hundred and twelve cases, the majority of which occurred between the ages of twenty and thirty years. No case exceeded fifty years of age and the sex of the patients was about equally divided.

Dermoid cysts have been found occupying all portions of the thoracic cavity and have had their origin near the upper portion of the sternum. The explanation for this fact may be that in embryo, during coalescence of the widely separated halves of the sternum, a piece of skin may become sequestered and then become dislocated forward to the outer surface or backward to the mediastinum, giving rise finally to a dermoid cyst in the thorax.

These tumors may cause a pleurisy and an exudation resembling pneumonia, or multiple cysts may form and resulting inflammation and pressure may cause erosion of the lung, rupture into a bronchus, erosion of a blood vessel, etc.

Dermoids in the thorax may be simple dermoids or complex tumors. There is authority for saying that most dermoids are of the tridermal type. One solid dermoid tumor of the mediastinum has been reported.

The symptomatology of the dermoids is of two distinct types; the simple dermoid causing symptoms by its presence and the cyst becoming an active irritant.

The size, dullness over the location, bulging of the suprascapular space, fixation of the ribs during respiration, absence of breath sounds and increase of voice sounds, hair and sebaceous matter in the sputum are all diagnostic. Differentiation from lung abscess, tuberculosis, aneurysm, and empyema must be made.

The usually rapid course of malignant tumors is an important point in diagnosis, though a dermoid when infected may grow as rapidly and early symptoms have escaped notice.

A differential diagnosis from benign tumors of the thymus and lipoma, also intrathoracic goiter is difficult.

Some cases will run long periods. Hemorrhage, and dyspnea, is a common cause of death. Size of the tumor, situation and reaction changes in and about the tumor are determining factors in prognosis. In most cases life is endangered unless surgical removal takes place.

The Rationale of Radiation in the Female Pelvis. By Albert Söiland, M. D. Los Angeles, Calif. California State J. M., November, 1921, p. 434.

THE author does not dispute that inefficient radiation may stimulate cancer cell growth, but states that there is no doubt that radiation properly administered destroys both nucleus and cell body of any tissue exposed to it.

After correct diagnosis has been made the rationale of radiation demands sufficient energy of radiation to obtain the best results in the shortest possible time.

Radium is practically a specific in cases of uterine hemorrhage of all sorts. Age limitations may be disregarded. In some cases intraurine radium radiation plus deep Roentgen

radiation brings quicker results. A twelve-hour application of twenty-five milligrams of radium in the uterine canal repeated once or twice within a period of six weeks is recommended. All cases which are favorable operative risks should be given the benefit of the best surgical skill. Cure is impossible when diagnosis of cancer of the uterus is unmistakable, but relief may be secured through radiation.

The author believes cure is possible in some cases of carcinoma of the cervix if all malignant cells are destroyed before the glandular tissue has become invaded. His technique consists of implantation of fifty milligrams of radium element, with a filter of one-half millimeter of silver, one millimeter of brass, and one millimeter of hard rubber, for fifteen hours, giving four such applications within six days. This treatment will destroy all malignancy within a radius of three centimeters from the center of application. This is followed by x-ray radiation over the lower abdomen through four ports of entry, giving a total of six hundred milliamphere minutes in a period of six days.

The technique is practically the same in treating cancer of the body of the uterus, except that radiation is carried up to the fundus if possible. If this is not possible then radium is packed in an additional two millimeters of hard rubber filter, the rectal wall is protected with two millimeters of lead and the mass inserted into the posterior culdesac. Additional tubes are placed in each fornix and exposure is carried to six thousand milligram hours within six days time.

In malnutrition, anemia, tuberculosis, etc., where permanent or temporary sterilization may be desired, intelligent radiation is valuable and the best method to use. Chronic oophoritis, leukorrhea, and pruritus vulvae are usually amenable to radiation.

Radium has proven itself of undoubted value in uterine carcinoma, but the extravagant claims made by European clinicians should not be accepted until proved.

The surgeon and the radiologist should cooperate in cases of uterine cancer.

The Immediate Effects of X-Rays on the Blood Lymphocytes. A Critical Study by Archibald Leitch, M. D., Director of the Research Institute of the Cancer Hospital. From Archives of Radiology and Electrotherapy, London. September, 1921, p. 122.

DR. LEITCH differs with the views of Dr. Russ, as expressed in his paper in the Lancet (April 26, 1919, p. 693). Dr. Russ, as the result of experiments carried out on rats, found the lymphocyte count to diminish fifty per cent on the average with exposure of the animal to x-rays.

Dr. Leitch repeated the same kind of experiments with the result of forty-six per cent diminution of lymphocytes in one rat and sixty-two per cent in another.

Believing it to be a risky thing to argue from an animal of one species

to that of another Dr. Leitch also experimented with human subjects. The clinical diagnosis in these was as follows: lymphadenoma, inoperable mammary cancer, lymphadenoma, tuberculous sinus of the abdominal wall, and one normal subject. The doses were the usual therapeutic doses. Blood was examined immediately before exposure and from one and one-half to three and one-half hours after exposure to x-rays. No subject had undergone treatment less than a month before the experiments.

The first two cases showed no diminution in the number of lymphocytes, rather an increase, which was, however, within the allowance for error in random sampling. The third case showed an increase beyond this allowance, but still a normal physiological variation. The fourth showed a diminution of lymphocytes of no great degree, the fifth a diminution of twenty-six per cent. This last subject was a very nervous type who was highly excited and unstrung by the simple technique of the blood test.

It is known that there is a continual loss of lymphocytes through the intestines and the effect of fright and nervousness on the intestines is also known. It is probable then in this fifth subject the normal loss of lymphocytes through the intestines was increased because of her nervous reaction.

Dr. Leitch again experimented on rats, doing away with the x-ray exposure and as far as possible doing away with the element of fright. One rat showed an increase in the number of lymphocytes and one showed a decrease of twenty-six per cent.

To avoid the element of personal bias a series of experiments were run in which blood samples of rats were tested before and after exposure to x-rays, but the identity of the rat exposed was unknown to the one making the count. In each case the x-ray apparatus was kept in operation, but in some cases the radiations were excluded. The treatment and results were as follows:

Treatment	Difference in lymphocytes
Lead screen interposed.....	-29%
X-ray tube cut out.....	-28%
X-rays four minutes.....	-69%
X-ray tube cut out.....	-37%
Docile rate, tube cut out.....	-15%
Nervous rate, x-rays two minutes.....	-64%
Docile rate (same as above) x-rays two minutes.....	-39%
Nervous rat (same as above) tube cut out.....	-59%

The data for the last two items were secured two days after the previous experiments.

The conclusion reached is that the diminution in lymphocytes is due to fright reaction and not to radiation.

Dr. Leitch disagrees with Dr. Russ in his view with regard to the effect of radiation on lymphocytes and also disagrees with him in his view of the defensive role played by the lymphocytes in malignancy. The evidence of this defense is not only not conclusive, but very questionable.

The Immediate Effect of X-Rays on the Blood Lymphocytes. By Prof. S. Russ. Archives of Radiology and Electrotherapy, Oct., 1921, p. 146. PROFESSOR RUSS makes reply to

Dr. Leitch taking exception to the conclusions drawn by the latter.

The length of time for a rat to recover after exposure to x-rays Prof. Russ finds to vary with the length of time of exposure. If exposure lasted twelve minutes recovery takes place within twenty-four hours, but if exposure lasts thirty minutes recovery takes from two to three weeks.

This interval of recovery he considers a safer indicator than blood counts as to the degree of disturbance caused by x-rays. Were this disturbance due to a fright reaction he thinks such rational association between the time of exposure and time of recovery would not exist.

Prof. Russ tried the experiment of excluding the rays by means of a lead covering. Ten rats were exposed for two minutes to loud sparking from the spark gap, but all rays were excluded from the experimental box. Then ten other rats were given a real exposure for twelve seconds. Blood counts were taken before and after on each of the rats and the percentage of lymphocyte changes were as follows:

Rats not exposed to x-rays	Rats exposed twelve seconds to x-rays
Rat No. 1 +69	Rat No. 1 -62
" " 2 +64	" " 2 -67
" " 3 +32	" " 3 -57
" " 4 +16	" " 4 -56
" " 5 +13	" " 5 -55
" " 6 +10	" " 6 -54
" " 7 +8	" " 7 -54
" " 8 no change	" " 8 -43
" " 9 -13	" " 9 -34
" " 10 -40	" " 10 -33

The conclusion drawn is that the fifty per cent lymphocyte reduction is a real x-ray effect.

The contrast afforded by the five rats used in Dr. Leitch's experiment may be due to the fact that those used by Prof. Russ were bred in the laboratory and therefore very tame.

Prof. Russ inquires into the proof which Dr. Leitch adduces that the reduction in the number of circulating lymphocytes is due to fright reaction.

Treatment of Ringworm of the Scalp by the Roentgen Rays. By Howard Fox, M. D., and T. B. H. Anderson, M. D., New York. Jour. A. M. A., October 22, 1921, page 1302.

ONE of the many benefits of the discovery of the roentgen rays has been to solve the problem of the treatment of ringworm of the scalp. Sabouraud expressed the opinion that no antiseptic would ever be discovered to cure ringworm of the scalp, because the root of the hair being inaccessible to antiseptics no antiparasitic remedy could penetrate the follicles to any extent as long as the hairs remained. Mechanical removal of the hairs was unsuccessful in ringworm. The solution of the problem was first suggested by the experience in 1896 of Freund & Schiff, who observed the fall of hair in a nevus they had treated with roentgen rays. The attempts to elaborate a technique for

the treatment of ringworm were unsatisfactory until 1904, when Sabouraud and Noire were able to announce the cure of 100 cases of ringworm by a safe method of treating each infected patch with a single application of measured roentgen rays. The entire scalp was exposed piecemeal over ten to twelve areas, the procedure requiring from three and a half to four hours. On the eighteenth day, the average time for the fall of hair, the scalp was washed and any remaining hairs were mechanically epilated. The head remained bald for two months, after which first downy and then normal hairs made their appearance.

The second important advance in ringworm therapy was made by Kienböck of Vienna, who devised a method by which the entire scalp could be irradiated at five separate points. This was adopted, improved, and popularized in England by Adamson.

The introduction of the Coolidge tube made possible a third improvement.

Briefly, it may be said that a definite quantity of ray may be given by proper control of the following four factors: milliamperage, spark gap (representing voltage), time and distance (from anode to skin). By means of a formula these factors can be changed when it is desired to modify the time of exposure, distance, etc. The method dispenses entirely with the use of pastils, is extremely simple and requires only reasonable care in its application and in keeping the apparatus in good working order (special attention being paid that the milliamperometer functions properly). The dose that is given to cause epilation is the equivalent of one Holzknect unit with pastil at skin distance, or four Holzknect units with pastil at mid-distance, or the equivalent of eight units of the Hampson scale.

In the authors' work with ringworm they have used a standard roentgen ray apparatus with Coolidge tube, interrupterless transformer, etc., and have followed MacKee in adopting the modified Kienböck-Adamson method. The hair begins to fall during the second or third week, when the scalp is washed daily and a five per cent ointment of ammoniated mercury applied to kill the spores on the falling hairs and prevent reinfection. The roentgen rays merely cause epilation and are not parasitocidal in the slightest degree. The authors have separately treated a total of ninety-eight cases and feel satisfied as to the efficacy and safety of the method. Sixty-three of the ninety-eight cases were treated at Ellis Island. Thirty-four of these have not been long enough under observation to judge of the ultimate result. Of the remaining twenty-nine, twenty-three were treated by the ray alone, and one by manual epilation after the return of the hair, while five were failures. Before being certified as cured the Ellis Island patients were subjected to rather a rigorous test.

Since 1904 a large number of cases of ringworm of the scalp have been treated, particularly in France and in England, by the roentgen rays. Adamson reported the treatment of seventy-five cases with perfect results. Mac-

Leod from an experience of three hundred and seventy cases considers the roentgen rays the most rapid, effective and painless method of curing the disease. Ceresole, in Italy, reported a series of one hundred and thirty-seven cases treated with most satisfactory results, ninety-four per cent being cures, with not a single case of radiodermatitis. MacKee in 1915 stated that he had employed the modern method of treatment for over eight years with only two bad results. In one case the hair failed to grow in one area, in another the hair remained sparse in two areas. He condemned the old divided dose method, saying "it is only employed now by those who cannot or will not modernize their technique. Dr. MacKee in a personal communication states that "over one thousand cases have been treated in Dr. Fordyce's clinic without the use of pastils. As far as I am aware there has never been a case of permanent alopecia. Reinfection and recurrence amounted to about five per cent."

The single dose treatment has now been in use for seventeen years. Cases previously requiring two years for treatment are now cured in three months.

In proportion to the large number of cases treated the amount of permanent damage has been extremely small. The possible danger of brain injury has proved by long experience to be wholly imaginary. MacLeod said "I have been unable to obtain any definite evidence of injury to the brain by this method of treatment from my own cases, from the literature on the subject or from any one with experience of this treatment; and the experiments I have done in this connection strongly negative the possibility." Sabouraud at first refused to treat children under two years of age, but later treated many infants of two years "always without ill effect."

CONCLUSIONS

1. From both a theoretical and a practical standpoint, the best treatment for ringworm of the scalp is by means of the roentgen rays.
2. With our present knowledge of exact measured dosage, without the use of pastils, the method is easy to learn.
3. With reasonable care it is safe, rapid and efficient.

The Therapeutic Aspect of Irradiation in Superficial Malignancy. Albert Soland, M. D., Los Angeles, Jour. A. M. A., November 12, 1921, page 1560.

THE great majority of medical men have accepted and placed a personal valuation upon this agency of healing in proportion to their individual knowledge of its potency, but nothing like unanimity of opinion exists in regard to its applicability to given conditions.

The author in this discussion considers alike irradiation from both the roentgen rays and radium. He employs them in similar wave length, so far as is possible to secure this result. All soft rays are screened out, only hard beta and gamma rays are employed, and the two sources of radiation are used conjointly.

There is ample and irrefutable evidence that cancer cells may be completely destroyed by irradiation, without any injury to overlying normal cell structures.

The rationale of treatment then is to ascertain the extent and exact location of a cancer area, and to apply to this sufficient irradiation to kill every pathologic cell within this field—a single cancer dose if possible. One must distinguish between an erythema dose and a cancer dose. An erythema dose, obtained with a gamma ray, may be an efficient cancer dose, but an erythema dose administered by soft ray technique may actually promote cancer cell proliferation. This while not proved is a decided possibility.

Cancer of the lip calls for more than ordinary good judgment in treatment; primarily a superficial lesion and its close association with the oral lymphatic channels soon converts it into a metastatic and generalized cancer unless initial treatment succeeds. It is of the utmost importance to lay down a radiation barrage which shall include every gland-bearing area in the jaw and neck letting not a single malignant cell escape. Lesions around the eye or the nose grow by extension and rarely metastasize.

Great care must be exercised when exposing skin areas overlying bone and cartilage, but with properly regulated dosage these may be safely treated.

In treating plantar warts one should be sure that a sufficient time has elapsed between treatments to avoid resultant ray necrosis.

Irradiation applied to keratotic and seborrheic patches is justifiable, but many of these yield readily to simple therapeutic measures.

Many surgeons rightly feel that cases are often irradiated which could have been treated more readily surgically. Surgery is rarely required in the cases enumerated, but in plastic or reconstructive work it should always be given first consideration. The habit of cutting out a piece for diagnostic purposes is a malicious one.

The attitude of a number of medical men who look upon radiology as a sporting proposition is very unfortunate. He who deals with radiation soon realizes that he has to do with a two edged sword, which he must either carefully lay down or else learn to use in a manner to insure his own self respect and to benefit his patients.

The modern radiologist does not hesitate to affirm that his method has accomplished more than any other medicinal agent to combat these unsightly and serious lesions.

A Warning Against Extravagant Claims for X-Ray Treatment of Cancer. Illinois Medical Journal, November, 1921, page 419.

THE Council of the British Association for the Advancement of Radiology and Physiotherapy have issued a statement to the effect that in view of the publicity that has been given to radiotherapy in the treatment of cancer by the publication of laudatory articles in the medical and lay press, and the extraordinary claims that have been put forward by the West London Hospital, it seems advisable

that a considered statement on the use of these agents should be made. The treatment referred to has not yet been thoroughly tested, has great potential dangers, and may not prove as efficacious as the claims now made would suggest. The unwarranted laudation of this change in technique will probably lead to a reaction, and bring discredit upon x-ray treatment in general. The claim put forward by the Erlangen School is that by means of their special methods it is possible to administer a dose of x-rays which will cure cancer in one application. Caustic comment by the *Lancet* is made mention of, in which it states that the undoubted good accomplished by x-rays in the cancer field cannot help but be lost sight of if extravagant claims, impossible of fulfillment, are given continued publicity.

Intra-cranial Complications of Nasal Accessory Sinus Disease—A Report of Sixteen Cases. By C. F. Yerger. *Illinois M. J.*, November, 1921, page 395.

INTRACRANIAL complications of the sinusitis are much more frequent than is generally supposed. The author's material was secured from observations made on sixteen cases selected from three hundred and ninety cases of sinusitis occurring in Cook County Hospital from 1911 to 1920.

The three hundred and ninety cases were of both the acute and chronic varieties. The frontal sinus was involved in one hundred and eighty-seven cases, or 48 per cent. This high percentage being due to the fact that the majority of these cases were of the acute type and diagnosis was made symptomatically and without recourse to the x-ray in about one-half of these. The maxillary was involved in one hundred and forty-seven cases, or 38 per cent; the ethmoid in forty-eight cases, or 12 per cent, and the sphenoid in nine cases or 2 per cent. A low percentage of sphenoid sinusitis is to be expected because this is the sinus least often affected and because of the technical difficulties of diagnosis.

Of these three hundred and ninety cases sixteen had intra-cranial complications. The frontal sinus was involved in nine, or 56 per cent; the ethmoid in nine, or 56 per cent; the sphenoid in five, or 31 per cent; and the maxillary in two, or 12 per cent. In eight cases, or 50 per cent, more than one sinus was involved. In four cases, or 25 per cent, the frontal and ethmoid sinuses were involved. In two cases, or 12 per cent, the ethmoid and sphenoid were involved and the same figures apply in cases of the frontal, ethmoid and sphenoid.

In order of frequency the complications ranged as follows: sphenoids, 55 per cent; ethmoids, 19 per cent; frontals, 5 per cent; and maxillary sinuses, 1 per cent.

The sphenoid sinus, though less frequently diseased gave the highest percentage of intracranial complications, while the maxillary sinus gave complications in only one per cent. This latter fact is due to the anatomical fact that unlike the other sinuses it does not come into direct communication with the floor of the cranium and infection from it must come through the orbit or through the

ethmoid.

Diffuse purulent lepto-meningitis was the most frequent complication, occurring in fourteen of the sixteen cases. No case of thrombosis of the cavernous sinus was found. Six cases were operated upon, of which four developed meningitis, probably as a post-operative complication. Two were modified Killian operations for chronic frontal sinusitis, one an enteration of the ethmoid, and the other an operation on the sphenoid, ethmoid and frontal sinuses with orbital abscesses.

Detailed histories of three cases are given in the original communication.

The Radiographic Evidence of the Influence of Cod Liver Oil in Rickets. By E. A. Park and John Howland; Harriet Lane Home and Department of Pediatrics, Johns Hopkins Hospital. From the Bulletin of the Johns Hopkins Hospital, November, 1921, page 341.

UNTIL recently cod liver oil was regarded by the authors as a most valuable in rickets, but was by no means regarded as a specific.

In the experimental studies the children were maintained upon the same diet as that upon which rickets developed, chiefly milk and cereal. The amounts of oil given varied from two to four cc. per day. Diagnosis was made by physical examinations and radiograms.

The criteria for diagnosis is found in the shaft and at the extremities of the bones. To the extent that the inorganic material in the bone becomes reduced the shaft is less capable of casting a shadow. The configuration of the shaft will vary according to the duration of the disease.

In normal bone the transition from shaft to cartilage is abrupt, the end of the bone being sharply outlined. In the diseased bone this formerly sharp outline becomes indistinct and as the case reaches an advanced stage a fringe develops sometimes several millimeters in length. The normal cupping at the end of the shaft is absent, sometimes no enlargement at all being apparent. This is due to the absence of inorganic material to cast a shadow and not to the entire absence of bone. If the rachitic process is extensive an abnormal distance will seem to separate the bones.

After treatment by cod liver oil changes are detected by the radiogram at the end of three to four weeks. The deposition of salts must have begun some time before they could possibly be detected by the radiogram. In two post mortem cases, one at six days after treatment had been begun, and one twelve days after treatment had been begun there was no microscopic evidence of calcium salts. The duration of the disease previous to the time of treatment may have some bearing upon the length of time taken to produce evidence of deposit.

At the end of two to three months calcification of the ends of the bones seems complete. The normal arrangement of the trabeculae, however, has not yet been restored.

Increase in the density of the shaft takes place coincidentally with changes at the extremity, but more slowly.

Periosteal thickening becomes strikingly apparent and centers of ossification are clearly outlined during the course of treatment.

Consistent results in fifty cases treated lead the authors to regard cod liver oil as a specific in rickets.

The Roentgen Treatment of Morbus Basedowii. Summary of Introductory Address at the Second Congress of the Northern Association for Medical Radiology in Copenhagen, September, 1921. By Joh. Fred. Fischer, M. D., Copenhagen. *Acta Radiologica*, September, 20, 1921, page 179.

AMONG four hundred and ninety patients treated for goiter there were eleven men. There were two classes of patients, those belonging to the working classes, who were treated at the hospitals, and private out-patients, who for the most part belonged to the well-to-do classes.

The prognosis varies with the two classes, since only the well-to-do are able to take the care necessary in this disease. In four-fifths of the cases a positive result was obtained, complete or partial cessation of symptoms. Recurrences occurred chiefly among the poorer patients. Nervousness decreased rapidly, increase in weight was usual. Perspiration and diarrhoea disappeared, also glycosuria which was observed in three per cent of the cases. In twenty-five per cent the pulse became normal and in fifty per cent it decreased considerably in frequency. Exophthalmia disappeared in several cases.

The usual dose was ten H with three Al. filters on four fields, the one on thymus, but a smaller dose to begin on if the attack had been serious.

Koehler's Disease. By H. Abrahamson, M. D. *Acta Radiologica*, September, 20, 1921, page 174.

KOEHLER'S DISEASE is an affection of the os naviculare pedis. It appears in children five to six years of age and may be unilateral or bilateral. There is often a history of trauma but none of preceding illness. Pains in the hollow of the sole, a halting gait, soreness on pressure of the os naviculare, slight atrophy of muscles in the lower leg, and often a slight turning inward of the foot to ease the weight on the inner edge are symptomatic. Though symptoms may be fairly characteristic only a roentgen examination can give positive and correct diagnosis. A diminished, condensed ossific center will be found in the os naviculare or the center will be formed in islets and the edges slurred or frayed.

Since Koehler published three cases of this disease (1908) about fifty cases have been reported.

Three views have been advanced as to its pathology. The first view holds that it is of traumatic origin. This is supported by Schultze, Stumme and Hanisch. In many cases there is no history of trauma at all, and in others the trauma is very slight, therefore this view is held a doubtful one.

The second view is held by Preisner, Meulengracht, Mouchet, and Roederer who regard the disease as due to pathologic fracture, though Meulengracht admits that defective formation or de-

velopment may play an important part.

The third view advanced by Koehler is that it is only a question of an anomaly in the development, a dystrophic process. Forsell adopts this view.

Clinical experience leads the author to adopt this last view as his own, though he believes repeated trauma may play a secondary part.

The Early Diagnosis and Treatment of Cancer of the Cervix. By Roland E. Skeel, Los Angeles, Cal. *California State J. M.*, November, 1921, p. 438.

AN early diagnosis is rarely made, and much of the responsibility is due to the lay tradition which teaches that menorrhagia is normal at the menopause—and also the ancient belief that cancer must be accompanied by pain, foul discharge and cachexia.

Thirty years experience leads the author to the belief that the microscope is the proper instrument of diagnosis.

If the general practitioner and the surgeon would cooperate together for early diagnosis the death rate from cancer of the uterus would be markedly reduced.

The author states his decided opposition to unnecessary operations and considers a disgraceful chapter in the history of surgery has been written by the over enthusiastic operators in this field; but he believes in the amputation of every cervix, in parous women beyond the age of child birth, in which there is an unhealed laceration, marked erosion and hypertrophy. He states that he has not as yet the courage to advocate high cauterization (followed by radiation) in all pathologically but not clinically diagnosable cases of cancer of the cervix, but he thinks this will come to be the practice.

For hopeless cases, having had experience with all known palliative measures for the past thirty years, he advocates radium as a means of relief. There is not the pain and discomfort with it attendant upon operation and greater relief is experienced from it.

In border line cases the condition and outlook should be presented with the utmost frankness to the patient and her desires then should determine what course will be followed.

Fractures of the Ulnar Styloid. By C. P. G. Wakeley, F. R. C. S., England, Surgical Tutor and Registrar, King's College Hospital. *Archives of Radiology and Electrotherapy*, October, 1921, p. 150.

FRACTURE of the ulnar styloid occurs very frequently, associated with a Colles' fracture, but seldom occurs as a single fracture. It is owing to the x-ray that these fractures are more frequently seen. Formerly fractures of the styloid process of the ulna and fractures of the carpal scaphoid were doubtless diagnosed as "sprains of the wrist."

All cases of injuries to the wrist should be x-rayed to insure proper diagnosis.

Direct violence is usually the cause of fractures of this type, though in some cases there is history of a twist.

In some cases soon after injury there is some oedema over the lower end of the ulna. Tenderness is not so marked as in the case of fracture of the carpal scaphoid. There is some limitation of dorsiflexion of the wrist. Crepitus does not exist. In late cases the radial styloid process is usually at a lower level than in the other hand.

The hand should be put up for about three weeks on a "cock-up" splint in dorsi-flexion with slight ulnar deviation. After union has been formed massage with the splint in place can be employed for a week after which the splint may be removed.

Descriptions and illustrations are given for three cases.

Injurious Combined Effect of Roentgen Rays or Radium and Topical Remedies. George M. MacCee and George C. Andrews, New York City. *J. A. M. A.*, November 5, 1921, p. 1489.

ON account of the widespread use of the roentgen ray and radium it is important for all physicians to know the effect of topical applications either before or after the use of either. Irradiation, whether or not followed by visible reaction, increases the sensitiveness of the skin. The degree of sensitiveness depends on the injury to the skin. Small or large irradiations followed by topical application may be followed by severe destruction of the skin.

After intensive roentgenization of the skin without reaction, the return to normal will be one month. After a burn of the first degree the skin may react normally in one month after the erythema disappears. This may be two or three months following the treatment. If there is permanent injury the return to normal may not be for months or years.

Fractional irradiation is cumulative in effect. Several fractional doses in one week or less produces an effect much the same as that following one large dose.

Stimulants, irritants and caustics make the skin hypersensitive to irradiation. The degree depends on the amount and strength of topical application. Any drug that is capable of producing a skin inflammation will make the skin more sensitive to irradiation. The remedies most often used and most likely to cause trouble are chrysarobin, scarlet R, iodine, mercury, pyrogallol acid, cantharides, resorcin, beta naphthol, tar, iodoform, sulphur, and salicylic acid. In powders they cause the least reaction, in lotions more, and in ointments the greatest.

Caustics, such as sodium hydroxide or potassium hydroxide, acid nitrate of mercury, zinc chloride, tin chloroacetic acid, nitric acid, silver nitrate, etc.

Ultra violet light may enhance the effect of roentgen rays and radium.

Great care must be followed in the use of carbon dioxide snow on surface that has been irradiated.

Prolonged applications of heat or cold and friction, especially if combined with liniments, may enhance irradiation effects.

The effect of these combinations is that of a radiodermatitis, and the burn

may be to the point of first, second and third degree burns.

A physician about to apply topical applications or irradiations should ascertain if any of these remedies have been recently applied.

E. W. R.

Observations on a New Method of Roentgen Ray Therapy in Psoriasis. O. H. Foerster and H. R. Foerster, Milwaukee Arch. Dermatology and Syphilology, November, 1921, pp. 638-659.

THE recent publication of Walter Brock from the Dermatologic Clinic at Kiel, on the treatment of psoriasis by roentgenization of the thymus, warrants the present study as well as investigations of others. The early experimental work showed that irradiation of thyroids, parathyroids, bone marrow and large areas of skin had no effect on the disease. But if the rays were accurately confined to the thymus region the response was an increase or decrease of the disorder. Proper attention to the dose, as well as the other details, leads to the disappearance of the lesions of psoriasis in from one-half to two and one-half months. Brock technique for adults is as follows: Two to four mm. aluminum filter, focus skin distance 20 cm., dose one-half epilation. Children receive one-quarter to one-half epilation doses. At first the dose may stimulate and temporarily make the disease worse. It improves, however, as the thymus is affected further. The portal of entry is bounded above by the lower border of the larynx and upper border of the clavicle, at the sides by the parasternal lines, and below by the fifth intercostal spaces. The complete adult dose is about 10 X.

An explanation for the action of the treatment is based on the assertion that hypofunction of the thymus is associated with psoriasis. Overstimulation arrests this condition. This presupposes the presence of functioning tissue throughout life. This theory is supported by the pathologic research of Hassall, Hammer and Hart. The thymus is known to be very radiosensitive. There is at first retrogression followed by regeneration and a supposed increase in activity.

In early youth, when the thymus is naturally very active, psoriasis is very uncommon.

The researches of others—Samberger, Sallhof, Peterson and Stephenson—go to show that roentgenization of the organs of internal secretion stimulates them to action.

The present report covers twenty-three patients extending over a period of five months. No other treatment was employed. The cases were all ambulatory. The technique adopted was as follows: Spark gap, eight and one-half inches; ten-inch distance; three mm. aluminum filter, five milliamperes, two minutes and forty-two seconds. After a few days in which the symptoms were aggravated, the lesions gradually disappeared. Eleven patients received two doses after two months, and two received a third.

In thirteen of the twenty-three cases the condition was at least markedly improved. In eight everything cleared up except a roughness on the elbows

and knees. In five the eruption disappeared entirely.

In patients showing recurrences the lesions were milder than the original. There was less response to treatment of recurrences than the first. Recurrences were stubborn in response to local treatment also.

These results show that the method is more convenient to the patient and that there is a response to thymus therapy. Though the number of cases treated is small, yet it is sufficient to justify this method as practical.

E. W. R.

A Comparative Study of the Pathology and X-Ray Densities of Tuberculous Lung Lesions. H. Kenon Dunham and John H. Skoolem. *American Review of Tuberculosis*, Vol. V., No. 4, June, 1921.

THIS study of abnormal lung densities has been limited largely to the normal and tuberculous lung tissue. Further studies are advised and give great reward for the search. This experience shows that normal lung tissue can be accurately determined. Normal lung tissue casts but slight shadows, and enhances the ease of determining pathological tissue.

Perivascular and peribronchial thickening are common words in medical literature. This study is partly to determine if they have a sound basis in pathology. It is found that neither term means tuberculosis unless peribronchial and perivascular thickening begins in fans in the periphery of the lungs. In this study it was never found unless the two pathological lesions were together.

The greatest advantage of an x-ray study is that it reveals pathology in the living subject. The character and development of the lesions can be followed through this development.

Etiology is deduced by considering the whole lung field. Prognosis is not so accurate as diagnosis.

Plates should be studied before the clinical history and physical examination are known. It is dangerous to read plates in the light of clinical history, for the tendency to read into a plate the physical findings is very great.

All over the country eminent roentgenologists are reading plates with different conclusions. The knowledge should be further standardized and correlated in order to arrive at a standard interpretation of x-ray chest plates.

X-ray diagnosis should not be accepted blindly by the clinician. It should only be used in conjunction with other laboratory findings to interpret and correct physical signs. Following cases to post mortem will check up all the methods employed.

Dunham has recently published a classification of x-ray findings of pulmonary tuberculosis. This has been used as the basis in more than five thousand cases studied at the U. S. A. General Hospital No. 19, where nearly one hundred and fifty cases came to autopsy. Further, one hundred and forty-six were studied at the Cincinnati Tuberculosis Sanatorium in 1920, with seventy-three autopsies.

1. Adult Tuberculosis.—Synonyms: Secondary tuberculosis, nodose tuberculosis, apical tuberculosis, chronic

tuberculosis, tuberculosis in the sensitized patient.

(a) **Apical fibroid tuberculosis.** Earliest findings localized tuberculous pneumonia; if lesion extends, chronic fibroid tuberculosis develops.

(b) **Gelatinous and caseous bronchopneumonia (with apical lesions).**

(c) **Lobar caseous pneumonia (with apical lesions).**

(d) **Fibrous pleurisy; pleural exudate.**

2. **Puerile or primitive tuberculous nodules.** Synonyms: childhood tuberculosis, tuberculosis in non-sensitized patient, focal tuberculosis.

(a) **Primary lesion and tuberculous nodules.**

(b) **Miliary tuberculosis.**

(c) **Basal tuberculosis.**

(d) **Tuberculous caseous broncho and lobar pneumonia (without apical lesions).**

(e) **Caseous pleurisy.**

These various types are fully illustrated by the records of over twenty cases. The records cover the reading of the x-ray plates and the gross and microscopic pathology. They seem to fully carry out the deductions of the author as given in his summary. An accurate piece of research of great value is offered to the literature.

E. W. R.

Tuberculosis in Discharged Soldiers.

Miles J. Breuer, Lincoln, Nebraska. *American Review of Tuberculosis*, October, 1921.

THIS is an interesting review of the diagnosis of pulmonary tuberculosis by an internist. The class of patients is of interest in as much as all of them are discharged soldiers, cf., presumably, early adult life. The clinical findings are arranged in valuable sequence in a manner not usually grouped, yet comprehensive. The arrangement is as follows:

Toxic Symptoms—

Weakness and early fatigue.

Poor appetite.

Afternoon temperature, etc.

Reflex Symptoms and Signs—

Hoarseness and cough.

Frequent colds.

Gastro-intestinal symptoms, etc.

Local Symptoms and Signs—

Hemoptysis.

Pleurisy.

Cough with expectoration, etc.

Specific Signs—

Tubercle in sputum.

X-ray.

The diagnosis was made on the basis of the presence of important signs and symptoms belonging to toxic, reflex and local group. The presence of the specific group was not considered essential. If the diagnosis could be checked up by specific signs it becomes that much more certain. However, when specific signs are present, the process is already advanced. It was the purpose of the author to make a diagnosis before such advanced stage was reached.

Total number examined, eight hundred; total number diagnosed tuberculous, fifty-eight; cases analyzed, fifty. X-ray examinations of the chest, twenty-one cases.

The percentages which follow are based on the number of cases in which both physical and x-ray examinations were made.

	No. Cases	Per Cent
Physical and x-ray diagnosis agreed exactly	15	71
Active by physical and inactive by x-ray	4	19
Agreed on positive diagnosis without reference to activity	19	90
Active by physical and negative by x-ray	2	9
Active by x-ray and negative by physical	0	0
Tubercle bacilli found in sputum	8	16
Sputum negative for tubercle bacilli	19	38
No sputum	23	46
Tuberculosis indicated by sputum, not by physical examination	0	0

The verdict arrived at by physical diagnosis is not made up of sharp distinctions. The same is true of the x-ray diagnosis. A case pronounced negative by x-ray and positive by physical examination may be interpreted in any of the following ways: "Roentgenologist failed to find or interpret signs actually present on the plate; internist too enthusiastic; both off the track; or, as in this case, physical signs . . . may appear before the pathological process in the lungs is sufficiently advanced to produce any change in the x-ray shadows. It will be noticed that the converse failure to find physical signs in a case pronounced positive by x-ray has not occurred in this series."

E. W. R.

Diathermy—Its Production and Uses in Medicine and Surgery. By Elkin P. Cumberbatch, M. A., B. M. (Oxon), M. R. C. P., Medical Officer in Charge, Electrical Department, St. Bartholomew's Hospital; Vice-President, Section of Electrotherapeutics, Royal Society of Medicine. Publishers, C. V. Mosby Company, 801-809 Metropolitan Bldg., St. Louis, Mo. Price, \$6.00.

THIS is a book of 189 pages, duodecimo size. There are forty-four illustrations, including some twelve diagrams, and fifteen plates.

The style is admirably simple and clear with all necessary but no tiresome detail included.

A clear idea is given of just what is meant by the term "diathermy." The nature of the current and the principle upon which it is produced is taken up and a historical sketch of the high frequency current is included here.

The parts and workings of the diathermy machine are explained in detail with the aid of diagrams. Descriptions and illustrations of the different makes are given with notes concerning their proper care.

A general explanation of the physiological effect is given and effects on the cardio-vascular system and the respiratory exchange are given in some detail.

This takes up about a third of the text and the next third deals with medical diathermy, which is first defined.

Methods and technique of applying the current are given and maladies and conditions for which diathermy has been found useful are recounted.

Case histories for the following are in this section: cases of subnormal temperature, neuritis, sciatica, arteriosclerosis, haemorrhoids and gonococcal infections.

The last seventy pages are devoted to the surgical uses of diathermy. Diathermic cauterization is described and distinguished from other methods of cauterization. The principles of this method are given and the electrodes used are described and illustrated.

Directions for experimental cauterization of muscle and liver tissue are given and the author recommends that these experiments be tried by prospective operators.

The method of treating malignant growths by diathermy is taken up under the following heads:

1. Anesthetic.
2. Choice of electrode.
3. Position of indifferent electrode.
4. Regulation of current.
5. Cauterization.
6. Bladder growths.
7. Tissues to be avoided.
8. Risks.
9. Effects.
10. Complications.
11. Sepsis.
12. Prolongation of life.

Particulars are given in several cases of the following nature: growths of the mouth and throat, inoperable carcinoma of the breast, growths of the female genitalia, rodent ulcer, non-malignant growths, other forms of morbid growths.

The Roentgen Diagnosis of Diseases of the Alimentary Canal. By Russell D. Carman, M. D., Head of Section of Roentgenology in the Division of Medicine, Mayo Clinic, and Professor of Roentgenology (Mayo Foundation) Graduate School of Medicine, University of Minnesota. Second Edition Thoroughly Revised. Octavo of 676 pages, with 626 original illustrations. Philadelphia and London. W. B. Saunders Company, 1920. Cloth, \$8.50 net.

THIS is a revision and enlargement of the earlier (1917) edition by Drs. Carman and Miller. The helpful and copious illustrations of the first edition have been increased by one hundred and twenty-two new ones and the list of protocols has likewise been added to. A new chapter on the hour glass stomach, and also a chapter on pneumoperitoneal diagnosis of abdominal lesions has been written.

The subject is treated in a broad way, such as might be expected from one of the author's experience and environment, but no smallest detail of aid to the diagnostician of more limited opportunities has been overlooked. The book offers sane and common sense suggestions throughout. Criteria for operable and inoperable cases are given and no opportunity is lost to elucidate points that may easily be obscure to many practitioners. As before, the effort is maintained to collect the well established facts and arrange the records in a systematic manner.

A short space is devoted to apparatus and general technique. Emphasis is laid on the fact that the screen and plate are indispensable complements

and that records should be systematically made and kept. Interpretation is next dealt with, and it is noted that industry, experience, judgment and care, not genius, are the requisites. Correlation and coöperation in diagnosis are stressed.

In taking up the different parts of the alimentary tract, the anatomy, the normal and pathological appearances are discussed first, and the technique of examination fully described. The relation of bodily build to visceral form and position is kept before the attention.

Eight chapters, about two hundred pages, are given to the discussion of the pathology of the stomach in the following sequence: gastrospasm, cancer, fibromatosis, syphilis, benign tumors, ulcer, hour-glass stomach, and miscellaneous gastric conditions.

A short chapter on the stomach of infants and children quotes the opinions of numerous authorities interspersed with the author's own.

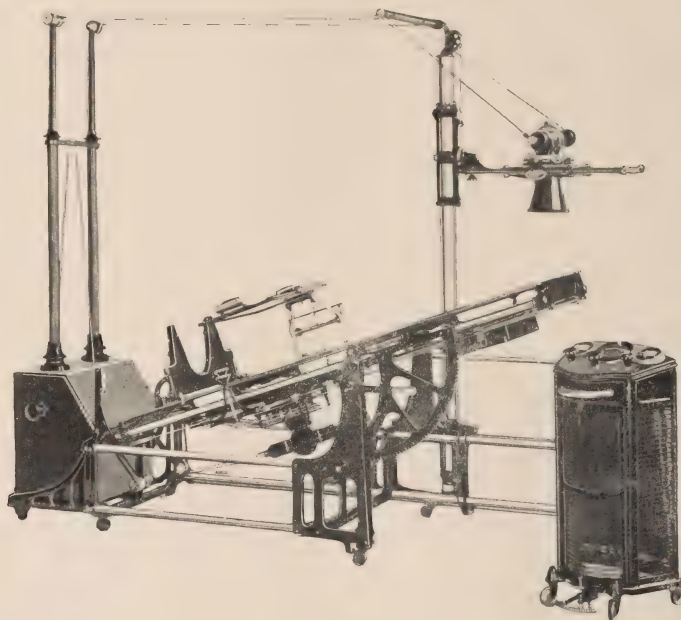
Another chapter on the stomach after operation states what, so far as it is possible to give, are the criteria for normalcy. Jejunal and gastro-jejunal ulcers are described, recurrence is discussed.

Gall-stones, the gall-bladder, the liver, the small intestine followed by a chapter on duodenal ulcer and one on miscellaneous lesions of the small intestine, the large intestine and its pathology are treated at length. A chapter is given to chronic intestinal stasis and one to chronic enteritis.

The references to the literature are given at the end of each chapter and a bibliographic index as well as a comprehensive general index is appended.



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Biological Determination of Radiation Dosage

FRANCIS CARTER WOOD, M. D.

Director of the Institute of Cancer Research, Columbia University
New York N. Y.

THE attempt to treat deep-seated neoplasm with highly filtered rays has lead to a realization of the fact that in order to obtain any permanent results, doses much larger than have previously been used must be given. Owing to the necessary limitation of the number of portals through which the exposures can be made, the dose which the skin receives must be terminated just at the point at which a slight erythema appears, or, according to some workers, in such excess of an erythema as is possible without producing irreparable damage to the skin. If this latter dose is in any way exceeded, very severe and even permanent injury to the skin may result. These statements are true, whatever type of machine is employed and are also true of any voltage which may be employed.

There is no evidence to show that the burns produced without a filter or with low degrees of filtration are any more severe than those produced by the use of thick copper filters and the highest voltages now obtainable.

The only point is that in the first instance it is easily possible to give four or five erythema doses in a few minutes, while with the higher filters and voltages, hours are required instead of minutes to exceed the proper limits of skin exposure. This, however, is true that with long skin distance and high filtration the high percentage depth dose which is possible under these conditions, may result in deeper sloughs. In any case it is evident that the possible skin dose is the limit to the exposure for a given area.

The determination of such dose becomes, therefore, a matter of primary importance before deep therapy can be properly administered as insufficient raying stimulates tumors instead of retarding their growth.

With heavy filters of any of the metals employed the methods previously used to determine dosage are extremely unreliable. The stimulation of the characteristic radiation of silver at about twenty-five K. V. renders photographic methods misleading. A similar error attends the use of pastilles containing barium and platinum, in addition to the fact that such pastilles are insensitive to short wave lengths.

Simple and accurate ionization chambers are not at present available. The use of types such as may be found in any physical laboratory implies the employment of electroscopes or highly sensitive galvanometers. In addition, their readings are by no means necessarily indicative of the biological dosage. With the advent of more powerful x-ray apparatus yielding voltages of two hundred thousand and over and a vastly larger output of x-rays through thick filters, the development of a convenient method of determining not only the skin dose, but also the amount reaching the tissues at a considerable depth, is imperative.

Unless the depth dose is known, it is perfectly possible by using four or five portals to administer sufficiently large amounts of x-ray so as to cause serious injury to internal organs or even to induce sloughing of the walls of the hollow viscera with fatal results. Fortunately, some types of cancer, though not all, are more susceptible to rays than normal tissues, a point about which develops all possibility of effective radiation treatment. But often the border line is a very narrow one; hence dosage must be accurate.

At present the only way for the x-ray therapist to estimate the proper dose is to determine the skin erythema with given sphere gap voltage, milliamperage, skin target distance and filtration. This is time consuming, and if the limit is accidentally exceeded annoying results may eventuate. After this, recourse must be had to tables of dosage

such as are published in current journals or in pamphlet form by Voltz and others. Measurement of the patient and estimation of the depth from the surface and thickness of the tumor give the other necessary data. The limits of error are evidently considerable and how much simpler the matter would be if a direct reading of all these factors could be obtained by an ionization chamber of such dimensions that it could, if necessary, be placed in contact with the tumor, if cervical, rectal, or prostatic, or under the patient if abdominal or thoracic, and direct readings in biological, not physical, units obtained.

With the scientific knowledge already available in this country such an apparatus could be designed and calibrated with a standard biological material and if a sufficient demand existed a number of firms in this country have the technical force available for their construction. I should like to see such an apparatus regarded as the essential part of the equipment of every one attempting deep therapy. Without such equipment comparable results are not obtainable and the successful therapy of those types of deep cancer amenable to x-ray delayed for another generation.

What are the scientific data necessary for the production of such a standard apparatus?

It has been often stated that the radiation effect on the cell is in direct proportion to the amount of energy absorbed by the cell. The amount of this energy for different wave lengths cannot as yet be accurately determined by physical means, but using an ionization chamber of aluminum, experiments conducted in the Crocker Laboratory have shown that equal ionization doses of unfiltered and of variously filtered rays do not have equivalent lethal effects on animal tumor cells. This has been confirmed by Kronig and Friedrich, who, however, demonstrated that

*Read at the annual meeting of the Radiological Society of North America, Chicago, Dec. 7, 1921.

with a chamber made wholly of horn and graphite, equivalent ionization doses had the same effect on tadpoles, on germinating seeds, the ovary and on the human skin, but they did not try animal tumors. It cannot as yet be considered absolutely settled that equal ionization doses are equally effective, no matter what the wave length of the x-ray. While it is probable that Kronig and Friedrich are correct, there are many who still believe otherwise.

Our nearest approximation to a biological standard now in use is the skin erythema dose. This, however, varies in individuals and over different portions of the body, as is well known, but as it furnishes the limit of all deep therapy it is still our only practical unit. Once obtained it is easily reproducible with the same x-ray apparatus under exactly the same conditions of working. It cannot, however, be necessarily transferred to any other make of apparatus, by any process of arithmetic. The yield of the tube depends upon many factors; the wave form which in turn depends upon the construction and adjustment of the rectifying switch, the transformer characteristics, and many other variables. Each machine must, therefore, be checked upon a human being, as has been said, which is time consuming, and if the limit is exceeded may produce permanent injury. If, however, some constant biological material was available, which required a given x-ray or radium dosage for its destruction, it would be easy to calibrate an x-ray machine or an ionization apparatus which would in turn give exact control over the workings of the machine.

Such a test object is available in one type of the transplantable tumors of animals. Those suitable for this purpose are transplantable in a high percentage in all breeds of white mice, and practically do not regress, except in rare instances. The animals are cheap and easily kept. They can be inoculated with the tumor and when this has reached a convenient size, it may be exposed to a dose some multiple of the assumed erythema. The strain upon which the largest number of observations have been made is Crocker Fund 180 and with it this factor is five. (1) After the exposure, the tumor is excised and bits are grafted on a series of animals. If the dose is correct no tumors will appear. If too low, some

will come up after a few weeks, or months, greatly slowed in their growth rate. Another tumor can again be exposed for a slightly longer time, and thus by a few trials the mouse tumor dose determined.

Such a test is more time consuming, however, than the determination of the erythema dose and obviously cannot be generally used. It would be far better if the x-ray apparatus could be biologically calibrated by the maker before it left the factory.

This lethal tumor dose has been determined on No. 180 for four successive years, using the same machine, which has not been altered in its adjustment, and checked with the same ionization chamber and has not varied. The deflections of the galvanometer have been within a couple of millimeters of the same point each time the machine has been run. It is made of aluminum after the design of Professor Wm. Duane. Recently a new set of machines of much higher power were installed under my supervision in another institution. Using the same voltage, distance and filters, and adjusting the current to give the same ionization deflection, the tumor was killed in the same time, as with the older apparatus, and the erythema dose on human skin was also found to be the same. With these factors available, the erythema dose for varying distances, voltages and filters was quickly obtained and in a few weeks the plant was treating effectively a large group of patients, with heavy dosage, yet without skin burns. For example—the lethal tumor dose at 166 K. V. 5 M. A. 40 cm. distance, 0.5 mm zinc and 1 mm. aluminum was found to be 180 minutes. The erythema was posted as a safe limit for the staff as not to exceed one-sixth of this, or thirty minutes to start with. Careful checks on patients have shown that under these conditions the true erythema is between thirty-five and forty minutes, depending upon the region treated.

The erythema dose which we use is a faint reddening produced on the skin of the chest or abdomen after seven to ten days, followed by slight desquamation and ultimate brownning. It is apparently the same as that of Seitz and Wintz, but not more than half of that used by Warnekros, who defines an erythema dose as such an amount as will not cause irreparable damage to the skin. The Warnekros dose, of course, causes skin atrophy and telangiectasis and should not be used on exposed portions of the body, and is so near the limit of permanent damage that it cannot be repeated on a sensitive skin.

The mouse tumor dose, however, is a fixed quantity and not variable like

the erythema. It is determined by one fact only, the death of all the tumor cells. If any survive, a tumor will grow from the transplant.

Can the fact that a highly malignant mouse tumor requires five erythema doses to kill all the cells at one treatment, be used as a guide to the therapy of tumors in man? I believe that it can, and should. The resistance of this tumor is comparable to that of the more malignant types seen in man, such as the tumors of the intestinal tract, the squamous celled epithelioma, but it is less than that of the melanomata and many of the bone and periosteal sarcoma in man, which often resist extraordinarily large doses. A slow growing fibrosarcoma of the white rat (Crocker Fund 37) for example, requires some eight erythema doses to kill it. Other animal tumors, however, may be killed with two or two and one-half doses, and correspond to the more susceptible growths seen in man.

It is very dangerous to assume that the proper carcinoma dose for human therapy is that which results in the destruction of a subcutaneous metastatic nodule from a carcinoma of the breast, as Kronig and Friedrich are careful to point out. They say that such disappearance may be only temporary after their "carcinoma dose" and recurrence take place later. This statement seems to have been overlooked by many writers who have assumed that the "carcinoma dose" necessarily means a curative dose. The conditions are entirely different from the primary tumor. The metastatic nodule, as shown by animal experiments, is certainly at least twice as susceptible and this susceptibility is probably due to the surroundings, imperfect vascularity, etc., of the embolic particle. When freshly deposited it will often disappear after the erythema dose, but if it does not every x-ray worker knows that at least a burning dose, say one and five-tenths skin erythema doses, is necessary, and when invasion of nearby bone or cartilage has taken place a still higher dose is necessary. Even a basal-cell carcinoma, the most benign type we know, is more difficult to handle after it invades bone or cartilage. It is often loosely assumed that the cells have become "immune"—an utterly illogical assumption.

The fact (1) that mouse tumors which have been exposed to nearly lethal doses in the animal's body, and then allowed to remain for ten days before inoculation, show a much lower percentage of takes than when they are immediately transplanted, has been cited as showing, but does not prove,

(1)—The details of these experiments have been published in the Jour. A. M. A., 1920, LX. They have been repeated in Germany by Keyser and others, who are, apparently, unaware of our work. The lethal dose with radium for this tumor was also published in the Annals of Surgery, 1915.

(1)—Keyser, Munch. Med. Woch., 1921, 68, p. 4.

that the tumor cells have been killed by any tissue, or immunity, reaction. It merely shows that when the transplantation is done immediately the cells are still in a healthy condition, and, therefore, the few which are going to survive are able to get started before the radiation changes begin, for it only takes about four days for a graft to organize its blood supply. If, on the other hand, the tumor is transplanted after eight or ten days, when the cells are all seriously injured by the development of the full x-ray or radium effect, the graft is in no condition to withstand the trauma and partial necrosis which such grafts always undergo when transplanted into a fresh soil before the capillary supply is organized.

Cancer cells do not become immune to repeated radiations, for if a mouse tumor is rayed with a sublethal dose and inoculated and again rayed and inoculated, and this process repeated a number of times, it still may be killed at the end of the series with exactly the same dose as at the beginning. The fact is rather that the cells of the resistant tumor are just the same as before, but that it is now impossible to attack the tumor through its blood vessels, which is all we do in many instances. The cells lie diffused through an avascular connective tissue, and while some may be killed, others remain to grow again at a much later period.

This is the condition so often noted when a tumor has previously been treated with radiation or caustics, a notoriously unfavorable condition. There is no evidence that the tumor cells have changed or become more resistant.

The carcinoma and sarcoma doses of Seitz and Wintz, or Krong and Friedrich, are, therefore, not generally applicable to all tumors, only the lymphosarcomata, and the basal cell carcinomata are permanently curable with an approximate erythema dose, and even these tumors occasionally show full resistance. Many, though not all of the carcinomata of the cervix, however, seem to be much more susceptible to radiation than tumors of similar morphology in other parts of the body. While an occasional lymphosarcoma will be permanently cured, it is too often multiple and inaccessible to offer anything but an accidental cure. The skin and cervix tumors are at present the great field for radiation, though if easily operable, both should be removed, to be followed by prophylactic raying. How difficult judgment is in these matters, and how imperfect as yet our knowledge of biological dosage and preferable technique is illustrated in the somewhat active discussion now going on in Germany concerning the value of what has been generally assumed was one of the best established fields for the x-ray, that is, post-operative raying after carcinoma of the breast.

CONCLUSIONS

I. It is extremely difficult to properly calibrate an x-ray machine for deep therapy as the difference between a stimulating and inhibiting dose for tumor cells is not very great, while the difference between the dose necessary to inhibit or kill the cancer cells and that which may cause serious injury or

even death of the patient is also unfortunately very small.

II. Exact surface and depth dosage is, therefore, a necessary preliminary to deep therapy. This is rendered difficult at present by the lack of suitable instruments calibrated in biological dosage such as a standard skin erythema.

III. The best way to calibrate such an instrument when constructed is by the use of a mouse tumor of constant and tested biological qualities. Such a tumor is the Crocker Fund No. 180. In five years of study, it has shown no variation in its x-ray lethal dose and this tumor takes in practically one hundred per cent, grows rapidly and regresses in only a fraction of a per cent in mice of any available market stock.

IV. The lethal dose for this tumor for x-ray of any voltage and any filtration is approximately six erythema doses as measured by a faint redness after ten days on the most sensitive skin areas. About five doses for heavily pigmented skin of the back and about two and one-half to three severe erythemas of the Warnekros standard.

V. In comparison to human tumors, it shows about the same resistance to x-ray as the highly malignant neoplasms of the intestinal tract which as yet evade successful radiotherapy.

VI. The lethal dose for radium for this tumor being also known, it furnishes the means for a biological comparison between the action of x-ray and radium and permits the estimation of equivalent dosage.



The Possibilities of Pneumoperitoneum in Gastro-Intestinal Diagnosis

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MUCH has been written on the subject of pneumoperitoneum as an aid to x-ray diagnosis of intra-abdominal lesions, but very little mention has been made of its application to examination of the gastro-intestinal tract. The use of opaque salts for examination of the stomach and intestines has practically established itself as the most efficient single method of gastro-intestinal diagnosis. There is absolutely no question of the efficaciousness of the present method of gastro-intestinal diagnosis, and any method which would supplant it must needs be very efficient indeed. The problem which does present itself, however, is to detect the weak places in the present method of examination and determine whether pneumoperitoneum will be of aid under these circumstances.

With the barium meal the portions of the stomach most accessible to examination are the greater and lesser curvatures, and the pyloric region. It utilizes a medium of increased density, while in pneumoperitoneum a medium of decreased density is employed; namely, gas. This is supplied by administration of Sedlitz powder. With a barium meal, the ordinary postero-anterior view shows very clearly, silhouetted against the softer structures, the presence of irregularities, filling defects, niches and incisurae. The examination is practically limited, however, to this single viewpoint. Fortunately, by far the greatest majority of pathological lesions of the stomach are confined to these parts and consequently the single viewpoint suffices in the majority of cases.

There are, however, a certain percentage of cases in which lesions are present in the anterior or posterior wall of the stomach. At times even the most intensive barium examination fails to detect the pathology. I recall very distinctly the case of a man with metastatic nodules in the liver, which had been definitely demonstrated with pneumoperitoneum, but because of practically no gastric symptoms or pathological findings in the stomach we entertained the diagnosis of primary carcinoma of the liver. There was no disturbance in gastric mobility, motility or peristalsis; no filling defect could be detected even by diligent search, and

numerous plates showed no evidence of involvement—yet, at autopsy, a carcinoma about three inches in diameter was found in the pars media on the anterior wall of the stomach. It is in

In the examination of the stomach by the aid of pneumoperitoneum it is well to start with a perfectly empty stomach; if there is any retention it is even advisable to wash the stomach out

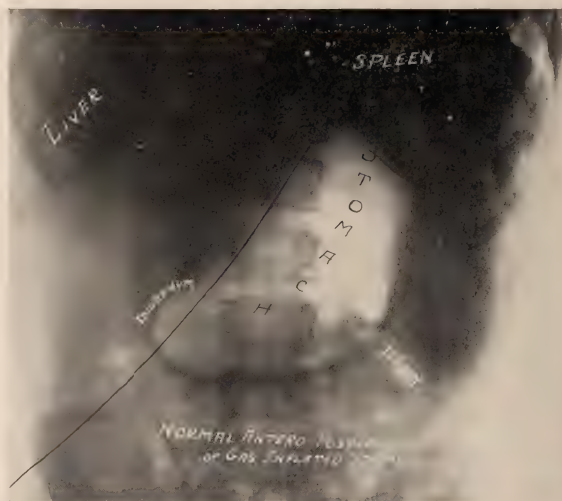


Figure I.—In the postero-anterior view the stomach is much the same as with a barium meal examination, but not nearly so distinct.

the examination of the anterior and posterior wall of the stomach that this method is most efficient, and I am quite confident that in this case it could have been easily detected had the examination of the stomach been made while the patient was undergoing pneumoperitoneum examination.

thoroughly previous to examination. The abdomen is cleansed, painted with iodine, and pneumoperitoneum is produced by inserting a lumbar puncture needle into the left lower quadrant. The apparatus which we use is very simple, consisting of a lumbar puncture needle connected to the pump of a Potain as-

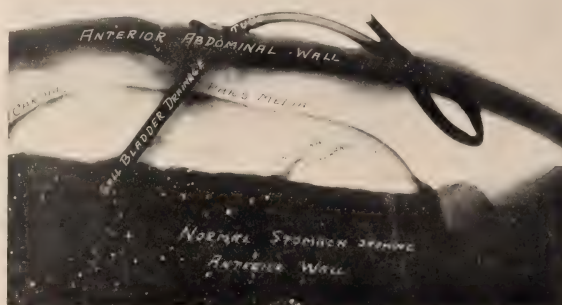


Figure II.—Anterior wall of stomach, descending portion, seen in the dorsal position. Note incisura angularis.

*Read at mid-year meeting of the Radiological Society of North America, Boston, June 3 and 4, 1921.

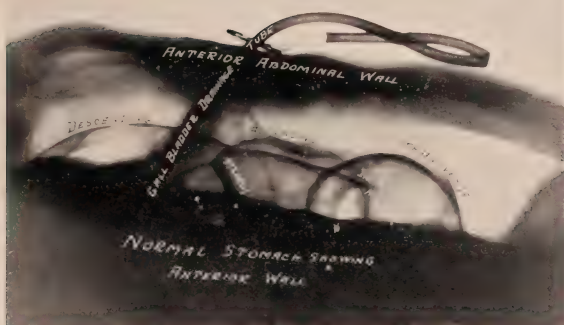


Figure III.—On rolling the patient slightly to the left the transverse and part of the ascending portion of the stomach come into view.

pirator by suitable tubing and connectors, with a Murphy drip interposed (vent hole plugged) to prevent introduction of foreign material from the pump. We make no attempt to sterilize or filter the air and deflation at the end of examination should be practiced routinely.

The patient being properly inflated, the examination of the stomach itself is then undertaken. To render the stomach wall visible the stomach itself must be inflated, and this accomplished by administering the two powders of a Sedlitz powder in separate solutions. If the patient's stomach is washed out on account of a residue prior to examination there would seem to be no objection to inflating through the tube.

The patient is examined before a vertical fluoroscope while lying on his back. The anterior stomach wall will be seen bulging forward and peristaltic waves can be very clearly seen originating in the cardiac end of the stomach and passing toward the pylorus. Rolling the patient slightly to the left, the pyloric ring and first portion of the duodenum can often be seen. On examining the patient with the horizontal fluoroscope, the gas filled stomach casts a shadow very much the same as the postero-anterior view of the stomach with barium meal examination. The image, in this position, is not so clearly visualized, however, and the same detail and outline of a barium meal shadow is not always attained. Using a barium meal in conjunction with pneumoperitoneum does not seem to be of great advantage.

Tumors of the posterior wall of the stomach, the other type of lesion in which this method would seem to be of advantage, are best demonstrated by

placing the patient in the retroperitoneal position. This consists in placing the patient in the prone position, supported by two blocks, one beneath the chest, the other under the thighs. This takes all pressure off of the abdomen and allows the abdominal wall to sag forward. The intestines and all organs with mesenteric attachment fall freely forward and render the retroperitoneal structures visible. A prevertebral clear space is produced which when unobstructed by very great enlargement or extensive adhesions of the liver gives a clear impression of the posterior wall of the stomach. In this position, even more than in the position for observations of the anterior wall, close study is necessary for proper orientation. The vertical portion of the stomach can be seen extending somewhat obliquely downward, while the transverse portion

bulges backward into the prevertebral space. It is likewise quite possible that this position will render the second and third portions of the duodenum directly visible, and diverticula of this region should be easily localized. Tumors of the head of the pancreas can be shown in their relation to the duodenum, but probably not more accurately than by ordinary methods.

Adhesions of the small intestines to the surrounding organs and to the abdominal wall constitute the most important lesions of the small intestine which can be demonstrated. This is by far the best method for showing post-operative adhesions to old abdominal scars, and even very extensive adhesions associated with tuberculous peritonitis can be shown. Where intestinal obstruction is present, as a result of old adhesions, this method will probably not serve to localize the site of obstruction any more accurately than the ordinary methods. When inflammatory lesions are present as a result of subacute peritonitis the condition can be readily recognized, since the intestines, instead of being easily displaced with changes in posture, are fixed in position. We have had several such cases and have no reason to believe that induction of pneumoperitoneum under these circumstances has any deleterious effect.

The contents of hernias, especially ventral hernias of the anterior abdominal wall, can usually be established without difficulty, pneumoperitoneum disclosing either the gas filled hollow viscus, or the dense omental tissue. When the operative findings are not known and there is a suspicion of malignancy of a stomach involved in a post-operative scar or hernia, this method gives excellent information, not only as to the possibility of malignant

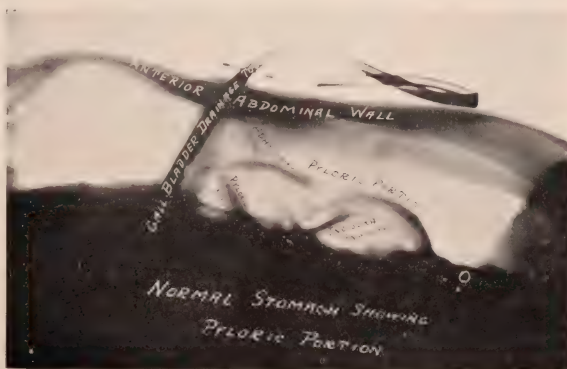


Figure IV.—On rolling the patient still farther on the side, the pyloric portion and pyloric ring became visible. Note the adhesions of the pyloric portion of the stomach to the gallbladder fistula.

involvement, but also as to the portion of the stomach involved in the hernia or adherent to the scar.

In examination of the large bowel it is extremely necessary to acquaint oneself with the appearance of the normal before undertaking any inferences of pathology. When the patient is placed upon the left side, in the lateral position, the ascending colon sags freely to the midline in almost its entire extent with the exception of the cœcum. It is well known that there is wide variability of motion at the cœcum in different individuals, so that the extent of normal mobility can be determined only after many examinations. This method will, however, give information as to the extent of passive mobility of the cœcum, and where a subacute appendiceal mass is present will show clearly its extent and limitations. Where there are no pathological adhesions, very little discomfort is experienced by the patient in the displacement of the intra-abdominal organs due to change in position; where, however, pathological adhesions are present, whether in the appendiceal region or in the region of the liver, any change in position which tends to put them on a stretch, will cause very distinct pain. This point will aid more than any other in distinguishing true pericoecal adhesions from normal attachments of the cœcum. The hepatic flexure rarely shows attachment to the liver, but the splenic flexure almost always has an attachment to the lateral abdominal wall and spleen which holds it more or less firmly in

place. When this structure, attached to the spleen and trailing down into the pelvis, was first encountered we were at a loss to explain its identity, but a barium injection soon revealed the nature of the structure. For the detection of carcinoma of the large bowel this method cannot be substituted for the barium enema, but in determining the extent of infiltration of such a carcinoma the method is of the greatest advantage. In a carcinoma of the descending colon the process was shown infiltrating the lateral abdominal wall and extending into the retroperitoneal tissues, involving the kidney above and extending well into the pelvis below.

It will be seen from this brief resume

that pneumoperitoneum examination of the gastro-intestinal tract, at least at the present state of development of technique, cannot be used as a substitute for barium meal examination; that it is especially applicable to certain lesions of the stomach most difficult to detect by barium meal examination, notably lesions of the anterior and posterior stomach wall; that it is practically the best method of examination to determine the contents of hernial sacs and adhesions of the intestines and stomach to each other and the abdominal wall, either post-operative or otherwise; that with a somewhat wider experience it may prove of great advantage in subacute or chronic appendicitis; that while it is not the best method of demonstrating carcinoma of the large bowel it is of great advantage in determining the extent of infiltration and the organs involved.

Aside from the very obvious advantages in the instances mentioned above, I feel that there are possibilities in the direct visualization of the pyloric ring and duodenum, which can be worked out by more painstaking technique and closer study, that may make the method of particular advantage in this location. In any event, the method demands more extensive consideration from those who wish to avail themselves of all aids in diagnosis and who wish to give the patient the benefit of all helpful methods at their command.

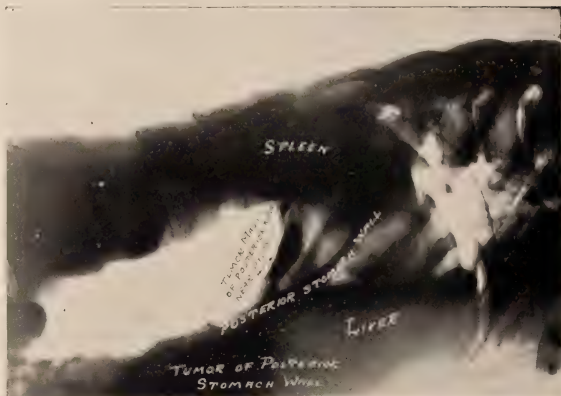


Figure V.—Tumor of the posterior wall of the stomach in the pyloric region which could not be demonstrated by barium meal examination. Note the posterior stomach wall in the descending, transverse and ascending portion of the stomach.

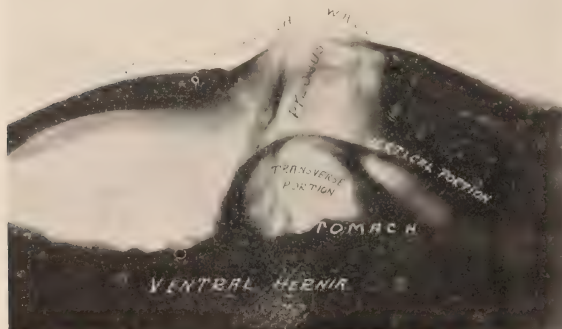


Figure VI.—Pyloric portion of stomach involved in a ventral hernia. Note the appearance of the transverse and descending portions of the stomach.

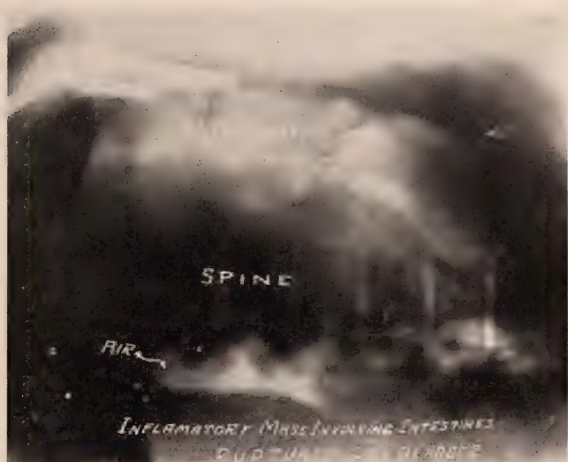


Figure VII.—Massive adhesions of the intestines in an inflammatory mass surrounding a ruptured gallbladder. Note the intestines do not fall away as they should normally, but are firmly fixed in place.

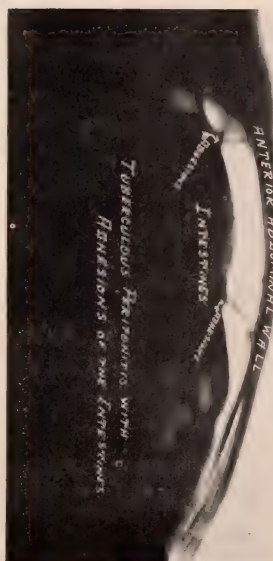


Figure VIII.—Tuberculous peritonitis, showing adhesions of intestines to each other and to the abdominal wall.



Figure IX.—Normal attachment of the cecum in the left lateral position.

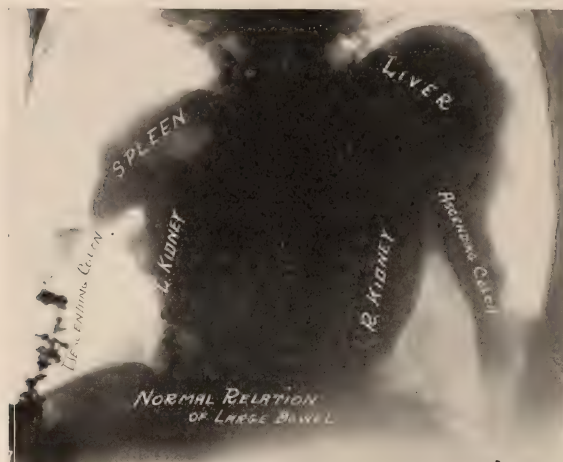


Figure X.—Normal attachment of the large bowel. The colon is attached at the splenic flexure to the spleen and lateral wall; there is occasionally a similar attachment at the hepatic flexure to the liver; this is the exception rather than the rule, however.

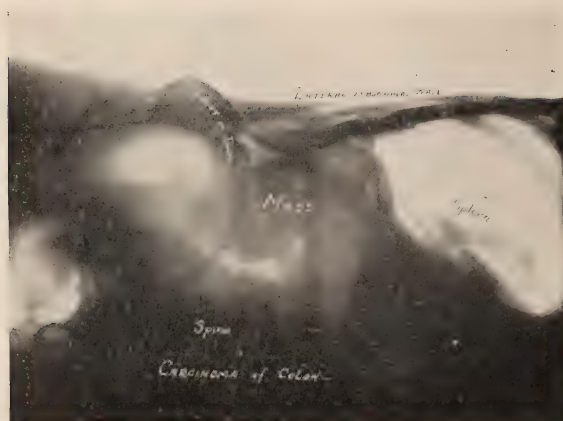


Figure XI.—Carcinoma of the descending colon infiltrating the lateral wall involving the retroperitoneal tissues.

X-Ray Studies of Mediastinal Shadows with Special Reference to Dermoid Cyst

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OF the many conditions found roentgenologically in the mediastinum, neoplasm, either primary or metastatic, is not frequent. Aneurysm of the arch of the aorta is quite common and may be mistaken for a neoplasm. Other shadows may be due to Hodgkin's disease, enlarged thymus, substernal thyroid, abscesses, echinococcus cyst and dermoid cyst. Fibromata, chondromata and lipomata (benign neoplasms) have rarely been found, and although they may occur, they have not been demonstrated roentgenologically so far as I am aware.

Of the malignant neoplasms, sarcoma is more common than carcinoma. Sarcoma is usually primary in the form of lymphosarcoma. Lymphosarcoma, however may be secondary. Sarcomatous shadows vary in size and contour and those due to metastases often appear rounded and circumscribed. These may be small or very large, and usually multiple. Lymphosarcoma usually manifests itself as a large single shadow and may occupy the greater part of the chest. Metastasis frequently follows malignant sarcoma of bone and may also follow sarcoma of the tonsils, cervical lymph nodes, the breast, or other regions of the body.

Primary carcinoma of the mediastinum arises from the mucous membrane of either the esophagus or trachea and rarely from the remains of the thymus

gland. It may occupy either the right or left side of the mediastinum or may occupy both sides.

It is not, as a rule, confined to the mediastinum alone and not infrequently involves the lung and pleura as well. Carcinoma of the breast not infrequently metastasizes to the mediastinum although metastases may also be due to carcinoma elsewhere in the body. It is difficult to absolutely differentiate roentgenologically between primary and metastatic carcinoma; however, the clinical history may help to decide. The shadows in primary carcinoma are usually irregular in outline and often invade the lung and pleura. Shadows due to metastatic carcinoma are usually more regular in outline and are apt to be limited more to the region of the mediastinum, although invasion of the lungs is not infrequent. In neither the primary nor the metastatic carcinoma have we seen calcified shadows.

Aneurysm of the arch of the aorta may be mistaken for neoplasm. It may be differentiated from neoplasm more quickly and probably better by the roentgenoscope than by any other method, through observation of the expansile pulsation. One must be careful, however, and not mistake a normal pulsation, transmitted to an adjacent neoplasm, for an aneurysm. Roentgenographically the periphery of an aneurysm has a somewhat wavy appearance, as its borders are not sharply defined, due to pulsation. In neoplasm simulating aneurysm the periphery is usually well defined.

Hodgkin's disease, roentgenologically, resembles somewhat lymphosarcoma; indeed, the mediastinal shadows of these two diseases cannot be absolutely differentiated. In the former the shadows probably are not as large as in the latter. Hodgkin's disease as a rule makes its first appearance in the neck and later involves other regions. The mediastinal involvement is usually a later manifestation of this disease.

Enlarged thymus is occasionally manifested by a shadow occupying the anterior mediastinum. A history of difficult breathing, substernal dullness with pressure symptoms, especially in infants or young children, should arouse suspicion of enlarged thymus.

Abscess in the region of the mediastinum not infrequently is due to an extension of an inflammatory process from the lung and pleura. It may also follow infectious processes of the ribs, sternum or cellular tissue of the neck. Occasionally an amebic abscess involving the lung extends to the mediastinum. Roentgenologically a mediastinal abscess usually has a sharply defined border. It may be fairly large. No pulsation is visible roentgenologically. The shadows are not quite as dense as those due to neoplasm.

Echinococcus cyst, which is very rare, occasionally involves the mediastinum. Its common site is the right side in the region of the base. It may be attached to the diaphragm and not in-



Figure I.—Large tumor shadow occupying the right and left mediastinum and half of right and left upper lobes, due to metastatic lymphosarcoma. Patient had lymphosarcoma of the tonsil five months previous which was operated and removed.



Figure II.—Marked infiltration of both apices and upper lobes, in all probability metastatic lymphosarcoma. The infiltration appears well organized and regular. Patient has lymphosarcoma arising from the wall of the pharynx.



Figure III.—Large rounded circumscribed tumor shadow occupying right apex and upper lobe. There are also smaller rounded circumscribed shadows in the right and left lower lobes. Patient had amputation of the femur three years previous for periosteal sarcoma. The circumscribed rounded tumor shadows are quite characteristic of metastatic sarcoma.

*Read at mid-year meeting of the Radiological Society of North America, Boston, June 3 and 4, 1921.

frequently is an extension upward from the liver.

Dermoid cysts arise in the mediastinum and vary in size from that of a walnut to that of a child's head. The small tumors remain in the mediastinum while the large ones may extend outward into the pleural cavity. A few have been described occupying the right base. In shape they are usually spherical, but may be flattened when in contact with the diaphragm. The cyst wall may be very thin or quite thick, and is invariably adherent to surrounding structures, most commonly to the pleura. Partial calcification of the cyst wall has occurred in a number of cases. Cholesterol crystals are a common finding, and in the majority of cases the cyst same time she noticed a slight bulging over this area. Since that time the right

chest has bulged and tumor has grown to the size of a peach. Pain has disappeared entirely. No other symptoms noticed except a lump. About a week ago patient developed a cough with coryza and general malaise. This has grown worse in the last few days. Dr. Bloodgood has had patient under observation for the past two weeks. He referred her to Dr. Kelly for radium treatment and patient has received seven treatments. Mother thinks the tumor has grown smaller and softer since treatments. Also contains hair, epidermis, cartilage, bone, teeth, etc.

Heuer of Johns Hopkins, who reviewed the literature of dermoid cyst of the mediastinum, stated that Roger Morris collected a series of fifty-seven cases in 1905; Dangschat collected a series of forty-four cases in 1903; and Pohl collected a series of fifty-two cases in 1914. Very recently Hertzler reported a case of dermoid cyst of the mediastinum in his Clinical Surgery.

Our case is one of a white female, age 14 years. Admitted to Saint Agnes' Hospital December 12, 1920.

Family History—Unimportant. Parents living and well. Uncle on father's side died of cancer, otherwise negative.

Past History—Had measles, whooping cough and scarlet fever. Subject to frequent colds. Tonsilitis several times. Otherwise negative.

Present Illness—About four weeks ago, without any history of trauma, patient noticed a dull aching pain at upper end of sternum. At about the

Physical Examination—Patient is a well nourished child of about fourteen years, complaining of a slight cough. Perfectly oriented in all spheres. No dyspnea, edema, jaundice. Skin is darkly pigmented, otherwise clear. Veins of left side of face and neck most prominent. The head is negative. The mouth and naso-pharynx are negative excepting that the tonsils are greatly enlarged and almost meet.

Thorax—Asymmetrical, the right chest apparently bulging slightly. In midline is seen a semispherical tumor about the size of a peach at the upper end of the sternum. This is soft and attached to the bone with a definite edge. The heart sounds are normal. On percussion there is a flatness from about the third rib on the right side out almost to axillary line. This cannot be separated from the liver dullness. Percussion on the left is normal except that the retromamillary dullness is greatly increased. Many mucous rales can be heard at the right apex and hilum, and at times a definite friction fremitus is heard to the right of the upper portion of the sternum.

Abdomen—Liver two fingers below costal margin, otherwise negative.

Extremities—Negative.

Blood—3,660,000 red blood corpuscles, 6,600 white blood corpuscles, hemoglobin, 68 per cent.

Urine—Negative except for a slight trace of albumin.

Roentgenoscopically there is a large rounded tumor shadow occupying the greater part of the lower two thirds of the right side of the chest. On deep inspiration this shadow moves freely and reveals lung structure posteriorly and below. The liver shadow appears somewhat depressed. It apparently is slightly attached to the diaphragm near the median line. No pulsation can be seen in this region. The upper right lobe and apex appear clear. The left lung is clear. The heart shadow is

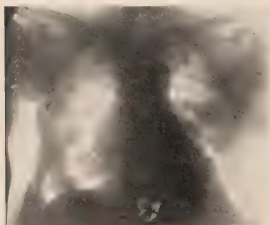


Figure IV.—Metastatic sarcoma of mediastinum and lungs twenty months after operation for sarcoma of the breast. The shadows are well defined, spherical and dense, quite characteristic of metastatic sarcoma.



Figure V.—Primary carcinoma of the lung. The infiltration involves the right hilum and upper lobe.

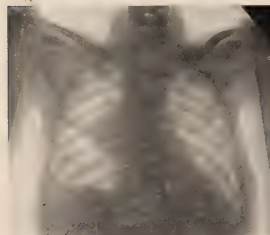


Figure VI.—Metastatic carcinoma right mediastinum and lung eighteen months after operation for breast carcinoma.



Figure VII.—Extensive infiltration of both lungs due to metastatic carcinoma. Patient has carcinoma of the sigmoid and rectum.



Figure VIII.—Dense fibrous infiltration of right apex and upper lobe extending downward toward the hilum. Infiltration simulates neoplasia, but is in all probability healed fibrous tuberculosis. Patient gives a definite history of tuberculosis.

displaced well to the left, probably the result of pressure by this tumor. The heart appears slightly enlarged. There is marked gradual curving of the dorsal spine backward. Stereoscopic roentgenograms and later roentgenograms of the chest confirm the above findings.

Impression—From the history and the above findings this tumor shadow is probably due to a large dermoid cyst. However, an echinococcus cyst is to be considered.

Operation—December 23, 1920, by Dr. Bloodgood. His notes of the operative findings are as follows: Novocaine. Incision made over swelling over sternum. This proved to be a cavity filled with thick yellow pus and granular debris, but on opening, adhesions of this cavity to chest could not be found. Incision then made below breast, nipple line, and rib removed. We then encountered, after dividing parietal pleura, a cyst. On opening it was found to be four mm. thick and to contain same material as cavity over the sternum, also hair. This made the diagnosis a dermoid cyst. Cover slips from piece showed no bacteria, no leukocytes.

Frozen section (of wall) showed fibrous tissue, no evidence of tuberculosis. Epithelial lining not seen.

The cyst rested upon the diaphragm below, to which it was slightly adherent, but from which it could be easily separated. To the outer side and above was the lung, with very few adhesions. This portion of the cyst could be separated, but the larger portion under the mediastinum could not be separated from the pericardium and further attempt at enucleation produced falling of blood pressure and rapid pulse. When this manipulation ceased, blood pressure rose and pulse improved. A

Brewer tube was sutured into the cyst and three pieces of long gauze, wet in salt, were packed in between the cyst and surrounding tissue.

Post Operative Course—Immediate rate of respiration. Patient had very acute thirst and drank about two or more liters of water each twenty-fourly after operation there was increased hours. The urine output ranged from three hundred to six hundred cc. in twenty-four hours. Before operation the urine was negative for casts with only a slight trace of albumin. It now showed plus one albumin and many casts. The temperature ranged between one hundred and three and one hundred and four.

For three days after the operation the pulse ranged between one hundred and forty and one hundred and sixty. The respiration averaged about fifty. There was rather free drainage around the tube. The amount of drainage through the tube was considerably less, being about two hundred cc. a day.

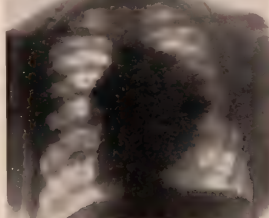


Figure X.—Large mediastinal tumor occupying greater part of right side of chest. Stereoscopically the tumor appeared more or less rounded in contour. Found five years after empyema. Exact nature of tumor not determined.

Examination of lungs showed pneumonia of right lung.

The night of the second day after operation, because of the decreased output of urine, patient was given magnesium sulphate and the bowels moved seven times during the night. The next morning the patient appeared very much better. The respiration had decreased to forty, and the pulse to one hundred and forty and the temperature to one hundred and three. The pneumonia of the right lobe seemed to be clearing up. There was very little cyanosis. During the afternoon patient's pulse, respiration and temperature rose suddenly, the respirations reaching sixty and the pulse one hundred and eighty and very weak. The patient became very cyanotic and died in about an hour after the sudden change was noticed.

Necropsy by Dr. W. C. Caldwell—His notes are as follows: The Brewer tube and the drains were removed. On introducing the hand into the cavity through the incision, it was found that the large cyst had occupied practically the entire space of the right lung, the right lung being pushed up into a small space in the region of the clavicle and apex. The cyst extended from the mediastinum to the liver, to the chest wall, and almost to the clavicle. There was a definite pneumothorax as the cyst had decreased somewhat in size, since drainage. On attempting to detach the cyst, it was found to be very adherent above, in the region of the clavicle, but particularly in the mediastinum, where it was so firmly attached that one was unable to separate it with the gloved hand. On opening the cyst it was found to contain a tumor mass about the size of an orange attached at the upper portion of the cyst. This tumor mass was removed. It was impossible to remove the cyst wall intact,

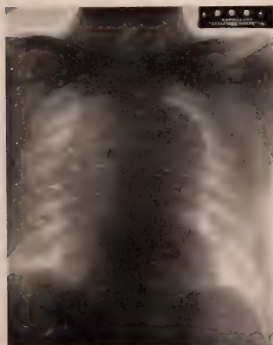


Figure IX.—Large fusiform aneurysm. Marked expansile pulsation noted roentgenoscopically.

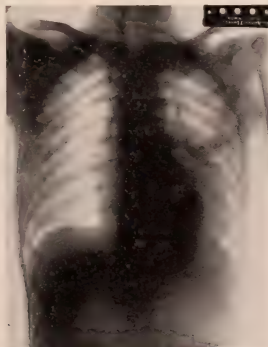


Figure XI.—Localized and well defined shadow in the region of the left hilum, mediastinum and part of the lower lobe, following pneumonia. In all probability walled off abscess.

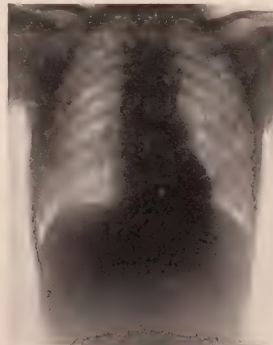


Figure XII.—Three weeks later, spontaneous rupture into bronchus with disappearance of shadow.

but a portion of the cyst wall was removed for examination. Examination of the small compressed lung showed what was apparently red hepatization. A block of this was removed for examination. There was now a cavity in the position formerly occupied by the right lung as large as a child's head.

Gross Pathology—The tumor mass which was irregular in outline, was soft and spongy in consistency, had a pinkish white appearance and looked very much like skin. It was covered with short fine hair. On section, the skin surface had a thin layer of connective tissue beneath, very similar to normal skin. Deeper down there was considerable fat and a connective tissue stroma. Piece of the cyst wall showed a very dense hard fibrous tissue almost like cartilage. Piece of lung showed consolidation.

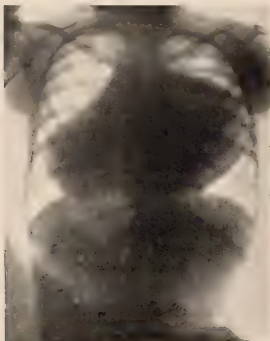


Figure XIII.—Dermoid cyst occupying greater part of the right side of the chest. This tumor is somewhat spherical and there is no expansile pulsation roentgenoscopically. The possibility of echinococcus cyst was considered because of its site. Cyst markedly adherent to the mediastinum and sternum so that it could not be completely removed.



Figure XIV.—Gross specimen of dermoid cyst, showing its skin-like covering and numerous hairs.

Microscopic Study—Section of the cyst wall was very similar to that described immediately after the operation. It was composed of very dense fibrous tissue and there was no evidence of an epithelial lining. No hair follicles, no sebaceous glands, no sweat glands.

Section of the tumor showed an epithelial covering very much like skin. There were hair follicles, sebaceous glands, and sweat glands. Beneath the epithelium there was subcutaneous connective tissue and fat.

Section of the lung showed a chronic fibrosis with later chronic inflammatory tissue and fresh pneumonia in the stage of red hepatization.

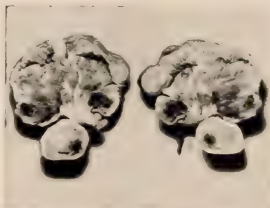


Figure XV.—Section through cyst.

From gross and microscopic findings it seems that the dermoid tumor with a pus material was inclosed in a fine fibrous cyst which probably represents a reaction of the body in walling off the original dermoid tumor.

Final Diagnosis—Huge dermoid cyst of right lung, firmly attached to the mediastinum.

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DISCUSSION

DR. J. C. BLOODGOOD, *Baltimore*:

I do not know what I can add in the discussion, but all of us must realize that due to the x-ray we have revealed the fact that the mediastinum is much more commonly involved than we have ever thought, even in primary lesions and in secondary lesions.

One of the most interesting observations I can speak of, which has not been mentioned, is the therapeutic dose of radium. If you have a mediastinal shadow, irrespective of the history, give intense radiation and there will be, in the great majority of cases, a reduction in the shadow. That means sarcoma. I have never seen after radiation a mediastinal tumor that I felt was carci-

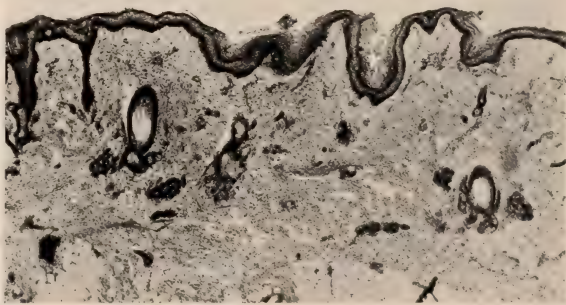


Figure XVI.—Photomicrograph of section of tumor reveals a definite layer of skin with hair follicles, sebaceous glands and sweat glands. Beneath the epithelium there is subcutaneous connective tissue and fat.

noma primary or secondary which showed any change whatever. In the little girl reported by Dr. Kahn, in which the huge size of the mediastinal tumor suggested a dermoid cyst there was no improvement whatever after radium. I felt it was unquestionably a carcinoma.

I do not for a moment feel that any of the sarcomata have been permanently cured by radium, but in all those we have been able to follow the sarcoma has grown very much smaller under radium. Of course, we can check a great number. There are primary tonsils and we take out the tonsils, or there are primary glands and we take out the glands and they show sarcoma cells. X-ray of the mediastinum is becoming a very important part of complete diagnosis. Unfortunately, we have not many autopsies.

The thing I am most interested in just now is the relation of mediastinal involvement in cancer of the breast. In the first place, here is a woman who has been operated on for cancer of the breast. She has some shortness of breath, some rheumatic pains, most of these patients are at the age where shortness of breath comes on irrespective of any malignant disease. Can you differentiate the shadows of cancer or malignant disease from some of the shadows we see in routine examination? If you take x-rays routinely of all your patients, you will see mediastinal shadows that are very difficult to differentiate. The reason I am calling attention to this point is that there seems to be a good many cases reported of mediastinal metastases after cancer of the breast. I think Dr. Kahn will agree

with me that of all cases of carcinoma of the breast in which the mediastinal shadow is of sufficient size to justify diagnosis, we have seen no improvement in the shadow nor are any of the cases permanently cured. I think perhaps some of the improvements are due to incorrect diagnosis of the mediastinal shadow. I think there is a great opportunity for all of us to attempt to keep most accurate records, especially of shadows in the mediastinum, so that when a patient with cancer of the breast comes up for routine examination with a shadow in the mediastinum we can watch that shadow. I do not know how many of you make the diagnosis of mediastinitis, but I would like to offer a prize to any one who has proved the diagnosis at autopsy.

Of course, with this little girl it was a great disappointment to fail to cure a perfectly benign tumor. Looking back, I think one mistake we made was to operate too quickly after radiation. This child had had intense radiation and then returned. The x-ray shadow was negative and we gave a second radiation. I feel now from my experience that that second radiation was unnecessary and that if radium was going to help that child it would have shown in two or three weeks. The failure to get a reduction in the shadow showed we were not dealing with a lesion that was amenable to radium. Some of my colleagues tell me that operation should not be performed too quickly after radiation. The radiation seems to lower the vitality of the tissues. One doctor tells me of a hysterectomy performed a week after radiation and the patient died of a streptococcal infection.

This little girl was operated shortly after radiation. Remember, this child had had no pressure symptoms and she had no trouble until the swelling appeared over the sternum. When I saw the shadow in the mediastinum and the swelling over the sternum, the probable diagnosis to me was tuberculosis. When I opened the swelling it looked like tuberculosis. I think that was a mistake. The question is, was it a mistake in operating and trying to remove that tumor. Some of you have not my record of thirty years of surgery. I have looked it over. I have had a very large experience in draining large cysts in the abdomen, especially pancreatic cysts. Whatever the technique, there is danger of secondary infection. All of those cases are infected, some of them die. I feel that when I decided to operate on this girl drainage was contra-indicated. I think Dr. Stewart showed that the drainage mortality was high. We did the operation under novocaine and the child was in good condition. We resected the rib and then with one hand we separated the cyst from the diaphragm and with the other hand we separated the cyst from the lung and it looked to me as though we would be successful. The mistake made was opening it. I should not have opened it. I thought by opening it I could reduce its size. Having opened it, I had to drain afterwards. I should have attempted to remove it without opening it. Having decided not to remove it, I should have left it alone and closed the chest wall. I think the child would be living today if I had not opened it. It was the opening and draining of the cyst that caused her death.



The Roentgen Ray in Uterine Fibroids,—Practical Deductions from One Hundred Consecutive Cases

MARY ELIZABETH HANKS, M. D.

Chicago, Illinois

BEFORE entering into a discussion of my subject I want to summarize, briefly, the tissue changes induced by the roentgen ray, one of my objects to emphasize the similarity between the artificial x-ray menopause and the normal menopause.

First: X-ray produces an edema of the endothelial lining of the capillaries, which causes an endarteritis obliterans with a resulting anemia of the tumor⁽¹⁾ and to a limited degree the genitalia.

Second: X-ray inhibits ovarian stimulation. It affects first the ripe and ripening graafian follicles, then the primordial follicles, and last, the interstitial tissue. The effect of x-ray on menstruation depends upon the number of follicles that are destroyed. Amenorrhoea will persist if all of them are destroyed, but if only the ripe and ripening follicles are influenced menstruation will be resumed when the primordial follicles develop.⁽²⁾

Third: The tumor cells, and especially the nuclei, may at first show hypertrophy. The chromatin coagulates, is diffused, and may be displaced into the protoplasm. Later vacuoles occur and the nuclei are obliterated. Finally, nothing is left of the cells but detritus, which is carried away by the leukocytes. Young connective tissue gradually takes its place.⁽³⁾ The uterus atrophies.

The internal secretions are not interfered with at all, or at least not until later. This belief is upheld by several recognized authorities.⁽⁴⁾ Doctors Eden and Provis observe that there is no compulsion nor psychologic change.⁽⁵⁾ In the cases under consideration the absence of obesity and the minimized disturbances of the menopause lead me to emphasize this opinion. The interstitial tissue of the ovary (an important source of ovarian endocrines) is the last to be influenced and probably escapes with full functioning powers.

You will agree that x-ray produces in the uterus, ovaries and blood vessels a striking picture of conditions prevailing at the normal menopause.

If to make amazingly good records had been my only object, some of my cases would not have been undertaken. It is my conviction that the woman who is not a good surgical risk, or the

woman who must attend constantly to the affairs of her business or home, or the woman who is averse to surgical interference and who understandingly accepts our best efforts, without question or complaint, should be given her choice of procedure if her case, under x-ray promises a relief to symptoms and end result of good health.

If one would attain the greatest success, he must become expert in diagnosis; he must have made careful records from an intimate knowledge of the progress of each case; he must have a sufficient number of cases from which to draw conclusions and to develop prognostic accuracy. If these are constant factors, I concur with Doctors Eden and Provis, who conclude their report of seventy-six cases by saying that the risks of failures with roentgen ray treatment, in suitably selected cases, are so small as to be negligible.⁽⁵⁾

The size of the tumors included in this series varies from the smallest admitting of diagnosis to one the size of a full term pregnancy. We should not permit size of tumor to occupy too important a place in estimating prognosis. The intramural hemorrhagic myoma that grows below the umbilicus in a patient forty years of age or more yields almost one hundred per cent in good results. One tumor included in this series, which came an inch above the umbilicus, is now after three years entirely gone. Large tumors conforming to the favorable type should not be refused. But the large or small indurated fibrous tumor that is non-vascular, that gives no history of hemorrhage, recedes slowly, and the less satisfactory results or failures usually come from this type. The majority of these cases, however, after thorough raving and the lapse of several months, yield excellent results in health and comfort.

It is generally agreed that the most favorable age is forty years or more. The average age of the hundred under discussion is forty-five years, the youngest being thirty. I cannot see that my thirteen cases, less than forty, have experienced unusual difficulties due to the menopause. I have come to believe that the menopause induced at thirty-five or even younger, if plenty of time is given to the process, is not a fearful event. A longer interval between series and a reduction of the total dose is the better practice. I must admit, however, that the cases under forty years

of age have presented unusual difficulties in obtaining results, being more atypical.

It has long been considered a final edict that only uncomplicated fibroids should receive roentgen or radium treatment. After observations extending over five years we are convinced that certain associated pathology is not a contra-indication to the roentgen ray, but rather an argument for it.

In many of my cases there have been erosions of the cervix uteri, some of them deep and threatening. In these cases we are careful to direct the ray into the cervix. Repeatedly we have seen prompt healing. Degeneration of the cervical glands is treated in the same manner. The glandular structure is reduced, the muco-purulent contents evacuated and the entire cervix takes on a normal appearance. In every one of our cases the condition of the cervix is estimated and it is included in the path of the ray, if indicated.

Follicular cysts of the ovaries—those disturbances that furnish inadequate excuse for radical surgery—have been much improved by x-ray, but while we have never seen them aggravated and we confidently expect them to repair, no definite prognostication is made. The simple follicular cyst should not be confounded with any other kind of ovarian tumor, which is immediately surgical. Sometimes it is difficult to differentiate between a fibroid and a large ovarian tumor that occupies the median position, but if we remember that x-ray reduces the typical fibroid and never reduces the large ovarian tumor we will not consume much time in arriving at the right conclusion.

Hemorrhage has been controlled in ninety-nine per cent of the cases. One woman probably has a submucous growth in addition to what was a large retroverted tumor. She was a bad surgical risk. After seven series of x-ray she had two thousand four hundred milligram hours of radium. Three months later she suffered from one of her worst hemorrhages. After waiting five months for results we resumed x-ray. Recently, following the twelfth series (covering more than two years) we seem to have made substantial progress, but anticipate more radium. The patient's general health is greatly improved and emaciation has given way to normal weight.

*Read at the annual meeting of the Radiological Society of North America, Chicago, Dec. 7, 1921.

It is always wholesome to analyze the causes of failure and below are some suggestions:

First: Failure and discredit come to us because of the too common practice of treating the patient without an examination which exactly locates the tumor and estimates the pelvic condition in general. One woman who reported to me had had several groups of roentgen ray treatments owing to persistent recurrence of the symptoms. The roentgenologist at no time examined the patient and did not know that the tumor was extremely retroverted and prolapsed so that the ray, always applied just above the pubic bone, and passing through an obese abdomen, barely reached the tumor, and, of course could not do full curative work. It is not surprising that continued x-ray was not favorably considered, and extirpation followed. I am now treating another woman, once discharged as cured by a roentgenologist who had never made an examination. These errors, like accidental burns, are avoidable and bring a distinct reproach upon our work as a scientific body.

Second: In general there is lack of thorough systematic raying continued beyond the time when menstruation ceases. In the average case not less than five or six series can yield the best permanent results. In obstinate cases the treatments should be continued cautiously as the exigencies of the case require. Twelve series (extending over two years) is the most I have given.

Third: Judging from my observations and reading, I surmise that the average operator is too casual in his diagnosis, his technique, his general conduct of the case and especially in his estimate of end-results. The treatment of so serious a malady is not a casual business, but implies intensive work and vigilance.

In making a survey of one hundred cases you can appreciate that it has been impossible for me to follow personally each one. I have arrived at my conclusions by a careful record showing the character and tendencies of the tumor, by a knowledge of the condition at the termination of treatment, by a determined "follow up" campaign, and by conferring repeatedly with the physician who referred the case. A large majority of the cases submitted today have had confirmatory diagnosis made by other physicians.

Two and a half years ago I reported to you my first thirty consecutive cases. At that time fifty per cent of them had no demonstrable tumors. Today the same thirty cases show fully eighty per cent without tumors. This fact illustrates that time is our most important

ally. After all treatments are ended the tumor continues to recede for months or even years, though it may need occasional encouragement.

The first sixty cases show seventy-eight and one-third per cent without palpable tumors. The last forty cases show only nineteen without tumors, or forty-seven and one-half per cent. Judging from the first sixty matured cases, this group contains several that will enter the no-tumor class.

As you will see, the last forty do not make the good showing that the first sixty made, mainly because the more recent cases are not matured, and because we have undertaken more difficult cases in which the prognosis was much in question. All of these understand the uncertainties attending their treatment. It is doubtful, however, whether it is advisable to accept such cases.

It is logical to inquire what is the status of those cases that still have demonstrable tumors. In answer I am glad to say that the great majority of them are "symptomatically cured," that is, the tumor is so reduced that the patient is not conscious of its presence. It is freely movable, the menopause is established and the woman is in good health.

The remaining cases are accounted for as follows:

Two immense tumors, one the largest of the series, the other very large and most unpromising, have been much reduced in size, and symptoms have been so completely remedied that both patients have recently committed themselves to matrimony.

One case encountered a gonorrheal infection which necessitated operation. This is included because it illustrates that while x-ray does no harm to these cases, neither does it do good, and the infection runs its natural course.

One, aged thirty years, had a myxomyoma, that unusual condition which is rarely diagnosed except after extirpation. Though the case did not respond satisfactorily to x-ray, her physician and myself were so confident as to the diagnosis that we gave the fourth series, excluding the ovaries as much as possible. The presence of the Wharton jelly-like substance (revealed by operation) explained the failure of x-ray. This woman has recently been delivered of a child at full term. The infant died on the fourth day—cause unknown to me. Though this one woman conceived after x-ray, that hope is no longer held out to any one. The cases on record are too rare. ⁽¹¹⁾

Roentgen treatment in one case greatly reduced the tumor and gave much relief, but this case died one year later of chronic heart disease.

Two cases discontinued treatments too soon and so remain in status quo, two we cannot trace, three problematical cases must have time to develop the facts.

It gratifies me to state that none have developed malignant symptoms. This fact authorizes one of the following conclusions: either malignant growths do not complicate fibroid as often as certain statistics indicate, or else the roentgen rays remedy the precancerous state, and arrest the incipient carcinoma or sarcoma that has escaped detection. Probably both are true.

In twenty-two years of gynecological practice I have never seen, to my knowledge, a sarcomatous degeneration in a fibroid and have seen but two fibroids complicated by carcinoma. My experience is apparently in accord with the experience of many of my conferrers and is not widely at variance with those who report recent laboratory findings.

From the records of The Presbyterian Hospital, New York City, sarcoma occurred twice in three hundred and fifty cases of fibroid operated, or one-half of one per cent. ⁽⁶⁾ From the Mayo Clinic Evans reports seventy-two in four thousand cases, or one and eight-tenth per cent. ⁽⁷⁾ From Mt. Sinai Hospital, New York City, Geist reports twenty-two sarcomatous cases in five hundred and forty, or a little over four per cent. Geist further says:

"To my knowledge there are no cases in which after or during the roentgen treatment a malignant condition has developed locally. It cannot be argued that the bad results have not been recorded, and we must, therefore, alter our point of view as regards the roentgen ray treatment of fibroids. If after irradiation and prolonged periods of observation, no malignancy develops in the uterus and no metastases occur, then we are bound to say, not only that the roentgen ray causes a beneficial result in fibroids, but also in cases complicated by sarcomatous change or those cases of sarcoma not diagnosed." ⁽⁸⁾

An excerpt from an article by Dr. John G. Clark is as follows:

"The next danger, that of sarcomatous transformation of the myoma, is also stressed with much gravity by many writers, but the cold laboratory records very greatly chill this side of the discussion. The fact is that sarcoma is seldom a degenerative or concomitant evil of myoma. Based both on clinical and on laboratory conclusions, therefore, we deal with fears solely within the domain of fallacious supposition in discussing the dangers of sarcomatous changes of myomas and fibroids." ⁽¹¹⁾

In the presence of these authorities, and many others, it is obvious that the

fear of sarcomatous degeneration should not deter from the use of x-ray; and to frighten a woman into operation by telling her that she is in danger of cancer is neither wise nor right.

Our technique has not materially changed in five years. We still hold to the cross-fire method: Coolidge tube, nine-inch spark gap, seven-inch skin distance, five milliamperes, four to seven minutes time.

For about two years we made the experiment of increasing the dose from ten to fifteen milliamperes minutes for each port of entry by increasing the time. We also increased size of port and reduced the number. Result—intense tanning of the skin with occasional peeling, patients suffer more from nausea and malaise, reduced buoyancy and confidence, the joy of getting well is conspicuously overshadowed. To my disappointment nothing was gained by the experiment. In fact, my first sixty cases were my banner cases. Comfort and a feeling of well being are very important to the patient, and if these can be maintained while the tumor is reducing satisfactorily there are distinct advantages. It is true that one large single dose may at once establish the menopause, but in general is not that one of the greatest arguments against it? My preference is to give time for readjustment and thus avoid shock and a stormy menopause.

Routine examination of the spine reveals that fully sixty per cent of the cases herein reported suffer from deviations, especially at the lumbo-sacral and the sacro-iliac joints. I am convinced of the following: That the slow recovery in some of these cases is due to the persistent congestion of the pelvis which accompanies this condition; that the severe back ache and pain extending down the legs are not always due to pressure from the tumor, but to this interference with normal poise; that tumors may even be caused by the intense chronic congestion accompanying this accident to the bony framework of

the pelvis. Whether this factor is etiological or not it is a complication to be reckoned with. My convictions have been verified by the response of the delayed tumor to treatment which reduces the mechanical defect and improves pelvic circulation both in blood vessels and lymphatics. This argument is far from conclusive, but it is suggestive and orthopedics may have a place in some of our severe cases. To employ helpful adjuvant measures is as logical in this specialty as in general medicine.

For the following reasons we have preferred x-ray to radium in the treatment of fibromyomata:

First: The roentgen ray works more slowly than radium; the menopause is not precipitated, but may require two or three months before it is established.

Second: The roentgen ray reduces the large tumor more successfully than does radium; the tumor coming to the umbilicus, if otherwise favorable, yields satisfactorily to roentgen ray, but would be impracticable for radium. So far as I can determine by reading little is said by radium exponents about the disappearance of tumors, small and uncomplicated as they usually are. Relief of symptoms seems to be the result sought and obtained in a large majority of cases.

Third: Roentgen ray can be successfully applied without loss of time, inconvenience or discomfort. Radium treatments require an anesthetic, from two to seven days in the hospital, and considerable uncertainty and suffering. It is a comparative ordeal, especially if the treatment is repeated two or three times, thus multiplying the periods of incapacity.

Fourth: The danger of roentgen ray in experienced hands is negative, while radium in the hands of the best radiologists may be followed by alarming complications and sometimes fatal results. Dr. Graves, professor of gynecology, at Harvard, says: "Too great emphasis cannot be laid on the danger of making intra-uterine radium applications in

the presence of pelvic inflammation. Even though the active inflammatory process existed years before, and there remains only a few peritoneal adhesions radiation is attended by risk. Inasmuch as an old inflammatory process is sometimes missed both in the history, and with the most expert preliminary pelvic examination, it stands to reason that even with great care occasional untoward results are sure to be encountered; and any one who says that intra-uterine application of radium (in bleeding) is attended with no danger knows little whereof he speaks." Two cases cited died from sloughing.

In conclusion: It is surprising that thousands of women, under the sanction and advice of their family physician, are still undergoing operation without being offered the information, to which they are entitled, about the roentgen ray. Time is proving that the roentgen ray has no rival in good results, easily accomplished, with no accompanying penalties.

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EDITORIAL

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A Scientific Renaissance

The post-war review with all its gorgeous trappings and misery, its unlimited satiety and shameful starvation, its luxuriant robes and pitiable rags, its unctuous virtues and damnable intrigues, constitutes a panorama which either congeals a man's blood because of his individual helplessness, or makes him sneer with derision and mockery at the utter emptiness of the shrine called civilization.

Social questions and scientific problems are being vehemently cast into the teeth of the four winds by the ultra-radical: they are being discussed broadly and fearlessly by the scientist: they are being studied painstakingly by the sociologist: they are recklessly bandied about in guarded and high-sounding terms by the politico-economist, or perhaps more correctly, the economic-politician: they are the subject of prayer and fervent discourse by the theologian: and the dear people, who always pay the bill, are trying laboriously and earnestly to learn where they go from here.

The fact is, everybody is having a fling at the job of juggling the present social chaos into an orderly picture so far as human intelligence makes that possible. The best minds, and the worst, measured by an abstract social code whose obsolescence is already decreed by the forces of intellectuality, are trying to prove that it is both possible and practical to keep the collective feet on the ground and the hydra-head of society in the clouds. They are trying to interpret the push and the pull of human affairs, and write out a mode of procedure which will definitely guarantee human progress by the clock.

A few references may serve to prove the point.

The disarmament conference has had a big try at establishing the future stability of society. At the moment of this writing, a world economic conference is about to be called. Periodicals by the dozen, including "The

Survey," "The Nation," "The New Republic," "Century," "World's Work," "The Saturday Evening Post," and scores of others, are at it hammer and tongs if they happen to belong to the radical group, carefully and with measured tread if they chance to lean to the scientific side, or conservatively if they belong to the intellectual type.

And of books on the subject in its myriad ramifications, there are already legion. Witness a few: "The Social Problem," by C. A. Ellwood, Professor of Sociology at the University of Missouri; "Sociology and Modern Social Problems," by the same author; "A Philosophy of Social Progress" by E. J. Urwick, M. A., Director of the School of Sociology, London; "The Foundations of Personality" by Abraham Myerson, M. D., Assistant Professor of Neurology, Tufts College Medical School, Boston; "Social Theory" by G. D. H. Cole, Fellow of Magdalen College, Oxford; "What Christianity Means to Me," by Rev. Lyman Abbott, of New York; "Elements of Sociology" by Franklin H. Giddings, M. C., Ph. D., Professor of Sociology, Columbia University, New York; "Vital Forces in Current Events" by Spears and Norris of the Department of English in the United States Naval Academy; "Democratic Ideals and Reality" by H. J. MacKinder, M. P., former Director London School of Economics and Finance; "Sociology—Its Development and Applications," by James Quale Dealey, Ph. D., Professor of Social and Political Science, Brown University; and "The Unsolved Riddle of Social Justice," by Stephen Leacock, B. A., Ph. D., Litt. D., F. R. C. S., Professor of Political Economy at McGill University, Montreal.

So it is, that whether a man travels from Paris to London by air, walks the streets of Berlin, takes part in the mad scramble for food in Russia, rides in the subway at New York, or attends a farmers' congress in Nebraska, the same questions are discussed. He hears something about Irish freedom, something about Russian relief, something about exchange rates, something about war debts, something about taxation, and something about high prices of the things men buy and the low prices of those things they sell. And nearly always, too, if the discussants happen to be men of family the conversation ultimately drifts into an exchange of intimacies about the baby, while if they happen to be unattached and fancy free, there usually develops an *ex parte* proceeding having to do with the merits or demerits of certain new fangled devices or methods introduced into this or that particular line of industry.

From which it may reasonably be inferred that there are two things uppermost in every man's mind: (1) the question of his own and

his family's health; and (2) the possibilities contained in the application of all manner of science for lightening his individual burdens as a member of society.

A review of the current literature is sufficient to prove the strength of this assertion. It makes no difference, in the last analysis, that up to a certain point each author meticulously follows that primrose path which in his judgment is best fringed to stage his argument conclusively. It makes no difference, in the end result, that from that point each proceeds in a delirium of ecstasy, spiritual mysticism, or cold logic according to which is best suited to the particular magic sought to be invoked as the solvent of the riddle which is now confounding the world.

It is not the purpose of this discussion to join issues with any author, or to lay down a divine *ipse dixit*. There is, however, something strangely fascinating, one might almost say prophetic, in the fact that every discussant grounds his theories and his hopes in two things, i. e., science and health, and of the two, the potentialities of health preponderate.

This fact justifies a few deductions and warrants some comment concerning the future of science in its relation to the question of public health. For when all discussions merge and flatten out on the proposition that science and health as separate factors in our social fabric are of fundamental concern; when it is argued that science is too abstract and too inhuman, and that each is both cause and effect in conditions which are not only unsocial but individually intolerable; when the radical condemns science because it is unhuman and the conservative recognizes the inviolable right of men and women to the blessings of health; when the scientist admits his own scientific failure because he has not been able to lengthen the span of his own life appreciably or overcome his own physical limitations; when the theologian is blessed in the presence of health whether it is founded on science or natural law, and confounded when he approaches the sick-bed; when the philosopher solemnly proclaims himself the possessor of powers beyond anything of which science is capable, and then illustrates the principle of *reductio ad absurdum* by insisting on receiving the services of scientific men in the first hour of physical and mental agony—when all these crazy anomalies occur every hour of every day, an enormous responsibility is laid on scientific achievement.

II.

Science, of course, needs no defence. Its record in industry, in commerce, in matters of health, is such that no man can be wholly oblivious to its accomplishments. No matter how unfamiliar a man may be with the inner circles of science, it requires but the mention

of a few notably scientific men—for example, Bell, Edison, Burroughs, Burbank, Osler, Pasteur, Rosenow, and numerous others whose niche in the development and enjoyment of human life is sustained by noteworthy attainment—it needs but the mention of these to send even the average man heading into an outburst of commendatory praise and thanksgiving.

Viewed in its relation to the future social structure, it is incontrovertible that true science has, by its own record of meaningful service, set itself a stupendous job. At the present moment all hands seem agreed that science holds, or at least seems to contain, the only dependable anchor for the leaky ship of state, the hard tossed raft of universal social stability, and the battered hull of public opinion.

Men and affairs are fluid. They have been torn loose from the old moorings. They are, as a consequence, in a very real sense adventurers. They are dreaming of, and talking about, a new world. And these fleeting visions they conjure out of the disappointments of the past and the hopes of the future prove so alluring that they refuse to return to those muddled relationships which caught them up, and carried them irresistibly into that vortex of confusion which was the climax of social and governmental complex as against which they had been unable to provide any relief. It makes no apparent difference that this lack of social cohesion and large social purpose is responsible for confusion worse confounded. For the moment, speaking broadly, men are content to hold themselves aloof from fixed social habits as much as possible because in that they find the privilege of viewing things as they are; because in that detachment they find some hope of changing the social status if ever so slightly, to make it the more nearly conform to those ideals which have come up with men through generations of adversity, human suffering, and political horse-trading.

Consequently, the job of setting up anything like a decently comprehensive statement of the present social problem in its entirety is an absolute impossibility. Even to touch some of its minor phases is a mighty perilous undertaking. One is certain to find himself involved hopelessly in an overwhelming torrent of facts and fanciful ideas, all of which enter into and have some influence on the composite social structure. And more likely than not, if the man who attempts the introduction of orderly purpose into the social structure doesn't have a hide sufficiently thick to make him absolutely impervious to personal insult, he will soon become an alternately laughing and weeping idiot because no man lives who has sufficient intellectual power and prescience to grasp the whole problem and reduce it to specific terms. Human relations are dynamic, disconcertingly dynamic, so that before one state of facts has been assembled, let alone sorted and studied through, quite another and different state is in vogue.

For these and many other obvious reasons, the sensible thing to do, indeed the only

possible thing that can be done, is to determine whether there is a common fundamental principle involved in all the aspects of human effort; and if there is such a thing, to strip it clean, and hold it up before the minds of men until it has become a ruling passion of public opinion. Such a course is justified, because it is axiomatic that, in any great social upheaval, if one single item of common interest, common agreement, and common appeal can be found, a clarion call to the rank and file of people everywhere will not fall on deaf ears peradventure that call be full-throated and sincere.

This is the opportunity and the obligation of scientific men, who should, as the result of their methods of thought, be able to chart the trend of affairs. For people generally are becoming conscious of the fact that unity of purpose is necessary, in the first instance, if society is to be saved, and in the second instance, if humanity or civilization is going to devise anything like an orderly and intelligent process of growth physically, mentally, morally, and economically.

It is not contended, of course, that the millennium is just around the corner. We do not entertain any hope that all the petty personal bickerings and controversial traits of human nature everywhere can be removed by the simple single expedient of a catchy slogan or a scientific investiture of the basic organizations of society.

But the disentanglement proceedings of the after-war clutter are more than the ordinary social scramble. It is the biggest crisis in history. It affects everybody everywhere. Some are suffering intolerable hurts. Others are moaning from sheer sympathy. Others are weeping and gnashing teeth simply to keep up with the fashion.

However, the fascination of social uncertainty and individual detachment from everything which symbolizes law and order and common habit is beginning to lose its glamor. First aid has been rendered in a million different ways. Men and women are beginning to stumble along the rugged path so lately blasted by the irresistible forces of common purpose. And as they grope along, struggling always to stand erect, there will develop in men's minds an increasing belief that after all, science is not purely a destructive thing, but that it can, by comprehension, understanding, and sympathetic direction, be made to serve human beings physically, economically, mentally, and spiritually in a bigger, personal and more decent human way.

The outcroppings are numerous and unmistakable. All that is needed to give the forces of social ferment direction is a master mind, composed of the best of all individual minds, actuated by vision, courage, and bounding human sympathy that will give it the mental stability to fling the burning torch of reason into the strangely combustible structure of public thought.

But whether it comes in the form of a sweeping reformation of our social fabric, or grows slowly and laboriously to full stature

through the costly and painful processes of experimentation, this one thing seems certain, and that is, science is facing a renaissance,—a fundamental reconstitution which will seek to preserve all of the hypotheses, theorems, calculi, and methods of abstract precision, and at the same time rip away all the impediments of tradition and divisional purpose, bind all science and scientific agencies into a cohesive and coordinated and constructively functioning unit, and breathe into the whole a vitalizing and warming spirit of large human service.

III.

If then, science is to preserve the warp and woof of its integrity, if it is to broaden its field of usefulness commensurately with social need by perceiving now the obligation which is being so unmistakably written out to measure its future conduct; if those men who proclaim its potentialities are influenced at all by the social concept of the elements of science which is being unalterably prepared by a distraught world and which may prove to be an epitaph quite as easily as a birthright, scientific agencies must of their own free will and accord, and with deliberate purpose, begin now seriously to construct an inclusive working plan which will contain some promise at least of a fair measure of attainment of those vital things men are thinking about. This is the larger part scientific men are going to be asked to assume in social affairs. They will be obliged, collectively and individually, to recognize that industrial processes however promising financially, that child welfare no matter how essential to any particular section, that old-age pensions, implements of war, and hundreds of others which might be mentioned, are but incidents in the larger theory they must evolve to cement the whole social organization and make it more nearly representative of the composite welfare of world society.

Cutting away all of the disputatious matters which are so easily injected into a discussion of this kind, and getting down as quickly as possible to the one outstanding premise which is common to all science else it must ultimately fail as a social instrument, it is entirely safe to assume that the whole scientific structure of the world must be reared bit by bit on the foundation of public health.

That premise insures the scientist a safe beginning and immediately brings to his aid all manner of workmen whose willings hands the scientist can employ and direct in building the common social edifice wherein will ultimately and permanently be housed the sociologist with his intimate knowledge of political institutions, the theologian with his spiritual interpretation of life, the economist with his arbitrary rules and regulations designed to establish safeguards for property and provide the necessary buffer mechanisms to insure an equilibrium between supply and demand, the statesman with his dreams of community interest, the industrialist with his pots and pans, and the professor with his eyeglasses and scratch-pad. In this way, and in this way only, can science be everlastingly established

in the rotunda of all human relations, not in the sense of dictator but as privy counsellor and friend.

And because of its broad knowledge of and intimate contact with, human life and health, medical science is peculiarly shoved into the foreground as being impressed with the desires of the human family and translating them into human scientific equations, finding their solvents, and out of these, fabricating a philosophy of health which will bind all men without savoring either of paternalism or oligarchy.

Naturally, many questions will be raised by narrow-minded persons about the relative importance of chemistry, metallurgy, biology, physics, engineering, and so on. But these are minor questions which will disappear when a really comprehensive effort is made to bring to the problem of health a coordinated, correlated, and synthesized scientific approach. Each branch of science as it is now known, and as it shall be expanded to meet the requirements of any such program, will find its sphere of labor and responsibility so great, and its work so absorbing and far-reaching, that anybody, save he be a hopeless bigot, will recognize that each divisional unit is equally essential to the success of the whole, and that none can function fully or intelligently except by means of harmonious and unlimited collaboration with all the others.

One might illustrate this proposition by calling attention to the interdependence of medical science and the science of chemistry. Certainly no medical man will be heard to say that he could practice his profession satisfactorily, humanly, or effectively without calling to his aid the products and laboratory skill of the chemist. And contravise, that chemist is a fool who has the temerity to assert that his is the dominating science and thereby inferring that the important problems of yellow fever, the black plague, malaria, pneumonia, and many other scourges known to humankind, could have been, and would have been, solved even through the science of medicine had not, after years of sacrificial study differentiated them and set them up as specific problems for attack and solution.

As we see it, the question of public health is no place for contentious elaboration concerning the superior importance or relativity of this or that particular branch of science. It is rather a question of such magnitude and vital concern that all truly scientific men will gladly extend the hand of fellowship to every other scientist in a sincere and deliberate effort to conceive some plan for the amelioration of human suffering and the prolongation of human life by the intervention and application of preventive methods.

The thing any serious student of this problem must acknowledge is that the medical profession, with all its weaknesses, fallibilities and organic failures, represents the point of scientific contact with the human family in a more intimate and comprehensive way, and because of its ideals and past achievements it is devoutly hoped, in a more understanding

and human way, than any other body or organization of scientific men. This statement is not made in a spirit of contention. But it seems necessary again to record the fact which supports the profound obligation medical men are striving earnestly to fulfill.

The apparent confusion of purpose among scientific men is perhaps accentuated by the further fact that within the past few years, medical men have come to appreciate fully their physical and mental incapacity to encompass all of the collateral sciences and apply them to the problem of the public health. They have also learned to appreciate the absolute right of the patient in whatever strata of society, to the benefits inherent in all science. Struggling always to accord men and women everywhere the fullest expression of scientific attainment, and laboring tirelessly to explore the fields of promise which they see forever broadening as their scientific horizons are lifted by exact knowledge, the medical profession long ago learned the value of sharing its burden by calling to the service of suffering humanity all kinds of scientific men, calling them too, not as underlings or hirelings, but as co-laborers in a field of activity where the responsibilities and possibilities are great enough for all.

That mutuality of effort is now about to be extended a little further. For with the advent of preventive medicine as an integral part of medical science, it becomes more and more obvious that intelligent and effective ministrations to the health requirements of millions of men and women everywhere, engaged in all sorts of occupations, and representing all stages of physical, mental and spiritual development and capacity, means a constantly increasing search for the unknown potentialities of all science, and a thoroughgoing collaboration with those branches peculiarly devoted to the psychological and sociological aspects of life. In no other way will it be possible to achieve a binding philosophy of health, embracing all and benefiting all.

IV.

These are the beliefs, the motives and the aspirations which actuated the establishment of a Research Department by The Radiological Society of North America. They are, also, the ideals, the spirit, and the purpose with which the work of that department will be conducted.

Naturally, much that has been said is general in its terms. It is impossible to discuss the broad phases of this problem otherwise. But the outstanding effort of the department will be always to specifically apply the principles underlying social welfare whether those principles be now known or shall at some future date be fixed.

To this end, as time and organization permit, specific studies will be conducted in sociology and medicine for the purpose of determining the etiological factors of disease. Other studies will be made as rapidly as possible of the various economic and social influences on biological conditions. Another feature will be a survey of the entire medical pro-

fession for the purpose of establishing a composite representation of medical opinion on various phases of medical science, and for the further purpose of getting from the profession at large its views and data concerning what should constitute a real constructive program of preventive medicine.

Speaking now of the peculiarly scientific side of the matter, an early attempt will be made to compile case report data from every source on the North American continent,—and later by cooperation with similar organizations in all parts of the world, it is hoped, like data from every available source. This will mean that the information thus secured will be classified according to disease, clinical history, pathological findings, treatment rendered, technique, subsequent length of life, and post mortem findings if any.

The importance of this information will be readily apparent to all medical men as well as others interested in scientific work. It is of especial interest, because it will, when fairly enough established to be representative, lay a proper foundation for strictly scientific research having for its object the determination of the question of the action of radiation on the tissues.

Many, many other things might be recounted which will fall within the province and the labors of this department. But it is believed a sufficient outline of the kind and the importance and the scope of the work being undertaken has been given to convey an idea of the earnestness and large purpose which this organization brings to this socio-scientific problem.

It goes without saying that conjunctive action along kindred or remote lines which will be helpful in any way in the study of this important question will be welcomed and suitably recognized.

Much of the work rather hastily sketched will require infinite patience and painstaking labor as well as occupy an amount of time not calculable with precision in advance. But there must be a beginning. The obligation is certain. The necessity is imperative. The time is propitious. The world is calling. And science has in its keeping the working machinery which will find the remedy for many individual and social ills.

Radiological Contacts

THE constitution of the Society, it seems, requires an annual address. In this there must be the usual effort to solve all our problems and since, by the courteous consent of all, the chairman is cloaked for this one occasion with keener insight on present status and future problems I accept the nomination to this annual folly with the hope that my remarks may later generate riper discussions.

Is the radiologist a specialist? There has been a running argument along this line for many years. The majority of us have rather sketchy ideas on this subject but we should nevertheless try to develop convictions regarding the niche we fill in the medical world. Every day we have definite problems to solve.

We go on making plates, buying books and apparatus, quoting each other—and wondering why we are not asked in for consultation on the final diagnosis. True, our plates and reports are there for the other specialists to glance over but we may be putting away in the dark room. The wise man, not satisfied with his environment, orients himself sufficiently to discern his difficulties and then either removes them or seeks a different environment.

A little resume of radiological history may help us to understand how we arrived where we are today. At first weak in physics, in technique and in pathology, radiology looked longingly out along the path—the steps from platinum to tungsten, from guess work to meters, from radiogram to post mortem were logically made. To name the men who guided this formative period would draw heavily on the early membership of the American Roentgen Ray Society. It would touch every man who has received an honor here tonight.

While our pioneer helpers were widening the field of diagnostic possibility, from bones and foreign bodies to peristalsis and soft tissue pathology, we stood out of the way of scattered radiation and read it all. Progress was made and the younger men were in it and of it. Knowledge of sinus, mastoid, kidney and pelvis, experience in plating, pituitary pathology, gall stone successes, pneumoperitoneum adventures—all these are credited to the younger men as well. The history of therapy has taken almost the same course. The older men speak with pride of their longer cures, while the younger men rush the harder after the greater sphere gap.

As a premise let us grant that we have all arrived—radiologists. We should not judge the radiologist as a friend of mine in the east did by asking "What has he ever written?"—nor as one in the west did the other day by asking, "What is his income?" A good radiologist, just as a good missionary, must be a sincere production but his foundation cannot rest on fervor and vision alone. Imagination and enthusiasm must be held in check and he must build upon the foundation laid to become an efficient doctor of medicine. If he has not been well grounded in anatomy, physiology, chemistry and pathology he is out of the running. If he has not the usual medical skill in weighing clinical symptomatology and in judging the ordinary possibilities of therapy and surgery he will be handicapped. Finally, if he is to attain the title of a really good radiologist and fully develop his specialty, he must study the new physics of radiant energy, pick up all the wrinkles of photography, acquire new knowledge of dermatology, dental pathology, orthopedics, and the other medical specialties. Besides this, if he is to be successful, he must develop business sense to take care of his overhead, and medico-legal caution to guard himself and his specialty. Whether he should also be a good politician is left open to discussion.

Although it has taken many words to discuss the requirements of a good radiologist, it

might possibly be put in a fairly brief statement as follows: A good radiologist is a man with a good medical education, who serves the public and profession of his community conscientiously, rendering the added diagnostic and therapeutic radiological aid with reasonable skill wherever legitimately required.

Granted that one has so developed, should he be satisfied? As long as some of the medical profession still say that only bones can be seen by the x-ray, as long as laymen ask for radium pills, and members of the American College of Surgeons make general statements disregarding and disrespecting the consensus of radiological statistics, so long must the radiologist do his bit of missionary work in organization. A missionary is a propaganda distributor. Conferences, congregations and conventions are for his help. Here he preaches the good of his cause and warns against sins of various kinds that are wont to develop. If his creed is one of too many dogmas his success will be narrow. If his organization becomes a closed corporation, his usefulness will be limited.

If his gospel purports to distribute universal helpfulness and to represent a broad geography, then the converts should be many and the membership large, the constitution democratic, with a machinery to prevent too small central control. His organization then becomes his teacher and by its mass opinion, becomes his protector before the public, and sponsor toward other medical specialties. Whether he remains a general radiologist or emphasizes a special field, depends upon the demands and possibilities of his location. If he is to be a good general radiologist in a populous district, he must be a wonder. His mental task of doing a quantity and quality of work in all the anatomical specialties demands familiarity with such a volume of new developing literature as few can hope to attain.

Should he do this, as almost none have done, what energy or time has he left to puzzle over his complicated contacts with the social public, the state legislature, the family patient, the referring physician, the clinic, the hospital, the college? To discuss each one of these contacts in detail, tonight, would be a travesty. A few points, however, might be brought up.

Regarding contact with the social body I recall the following bit of history in the form of a committee report adopted in 1907 by the American Roentgen Ray Society. It reads as follows: "The proper fees to collect for x-ray work:—Vesical Calculi, \$50.00 to \$200.00; Chest, \$25.00 to \$100.00; Shoulder, \$25.00 to \$50.00; Stomach, \$75.00 to \$200; Foot, \$15.00 to \$50.00; Teeth, \$75.00." The members tried to live up to this for a number of years and it may have been a mistake and may have injured our standing with the public and the referring physician. Our own organization should watch its occasional overcharges for radium and deep therapy. Radiology, like other branches of medicine, has a definite social aim. It is one of the public utilities and if not administered reasonably

may be taken over by the State. If this happens it will inevitably lack the scientific genuineness of the present.

Radiology, which includes radium therapy, is a new science and must combat the over antagonistic knocks of the aggressive surgeon as well as misquotation in the lay press. On Oct. 24, 1921, John Blair Deaver, M. D., at the congress of the American College of Surgeons in Philadelphia made the statement that radium cured only certain types of superficial cancer. On Oct. 25th, the Associated Press report read as follows: "Radium as a Remedy for the Relief and Cure of Cancer Has Failed." As a society doing work in this special field we know that many cases of otherwise hopeless cancer have been relieved by the use of radium and we should not stand silently by and allow the fire of hope to be dashed out with one public splash.

State boards must be convinced that radiological practice is medical practice and must be brought under the medical practice acts. In some states non-medical technicians are permitted to make diagnoses and to practice irradiation therapy. In other states the x-ray outfit embellishes many a chiropractic's office. Our organization should encourage an educational mass action directed toward correction of these abuses. I understand that very recently in the east several government contracts have been given to lay technicians.

In dealing with the referring physician, we should try to develop his understanding of our place in the diagnostic circle, and his appreciation of the technical difficulties and negative possibilities. He should be calmed into allowing us to say "I don't know" once in a while or to accept from us the same as he perchance may be obliged to give—a personal opinion—for what it is worth among the preponderance of data—the correct answer to which perhaps the Lord only knows.

Dr. Pfahler in 1910 at Detroit said: "In order to gain the confidence and support of the public and the profession we must show ourselves worthy of it, by being thorough students. We must eliminate guess work and either state absolute facts or say we do not know. Pathological conditions vary so much in extent and character that we must not be too dogmatic. The clinical symptoms and x-ray shadow often give more than one possibility."

Let us hope that if we are connected with a group, it will not be too small a group. Our wings must not be clipped by salary considerations or clique decisions if we can develop strength to fly. Let us feel if we are associated with a hospital, the rare opportunity for correlation and follow ups. Let us be sensible of the tragedy of wasted opportunity and loss of clinical records. If no other department supplies a camera for visual records, lantern slide making, etc., let us do it ourselves even at the possibility of being called photographers.

If the College of Surgeons is really standardizing our hospitals let it demand as a minimum that the radiological laboratory be the responsibility of a medical radiologist. No

more important department exists in the hospital, because it assists all other departments in making diagnoses and renders valuable aid in the treatment of disease. If complete it is necessarily expensive. This need should be explained to both trustees and the public and they should be made to feel that poor equipment and cheap technique means debauches of error and bills of disaster.

The contact of radiologist and hospital staff members forms a side problem. Barclay, of Manchester, feels that the radiological laboratory can be made a congenial meeting place, with afternoon tea as a possible aid to greater good fellowship and better work. This scheme may not be practical in America because of different social customs but it offers a suggestion. The division of interests becomes less as our associations become closer. The standpoint of other medical specialties can better be studied in an atmosphere of good fellowship,—and the horns on our bread and butter competitors will atrophy. When a competitor, local or otherwise, does good work we should support him and praise him. He is not lessening our future income but building up confidence and worth in our field and increasing the general demand in which we all will profit.

We have been accused of working for profit, of working "for what there is in it." Yes—we might plead guilty if by profit were understood something that means more than money. Total profit includes a feeling of mental growth, increase of technical skill, an understanding of and sympathy with the needs of the community, and a sense of worthy satisfaction. These are things that money alone does not bring to us.

We are proud of the present status of the Radiological Society of North America. The organization by mass feeling is developing more harmony in scientific controversies and in working out its problems. The pendulum of discussion is swinging less and less and coming to rest more and more on such discoveries as direct duodenal diagnosis of Cole, the meaning of the apical fan of Dunham, the value of the diaphragm principle of Potter, also the non-significance of dropped stomach as emphasized by Mills and ileocaecal valve incompetency as discussed and dropped by Case. Other problems are still enjoying a wide swing. Among these are pathogenesis of gastric ulcer, method of lung cancer infiltration, meaning of sella turcica, mastoid and appendix findings. The radiologist will probably soon be obliged to go outside of his specialty to find things to quarrel over—for the brakes of parallel work and group scrutiny have been applied to all visionary and over enthusiastic deductions.

We must admit that up to 1915 radiologists were insufficiently organized. According to statistics, gathered by Watkins of Phoenix, only fifteen to twenty per cent had joined any organization at that time and during the five previous years there had been only sixty who had done so. By way of emphasizing the evidence of the recent rapid growth of radiologists into organizations we may note that in

1915 the American Roentgen Ray Society took in only sixteen new members at its sixteenth annual convention at Atlantic City. In 1920, five years later, the Radiological Society of North America took in two hundred and eighteen new members. This year two hundred and fifty new members were added. We are not afraid however of becoming too heavy. The program of this convention gives us a secure feeling that the older members who represent the roots and main growth will be equal to the strain.

I make no mention of problems for the incoming president, Dr. Soiland, to attack. I have great trust in his discernment, energy and ability.

I cannot take the time to mention in appreciation the sources of my help during the year. It would name all my councilors and fellow officers. Mine has not been the push or pain of the pioneer, but I wish you to know I have been fully sensible of the support, loyalty and honor you have all given me.

Alden Williams, M. D.,
Grand Rapids, Mich.

*President's address read at the Annual Meeting of the Radiological Society of North America, Dec. 8, 1921.

The Future of Medicine—The Ideal to be Sought

I wish to quote to you from Conway:

"To a human being his ideal represents his individual existence. One life we each have, which is merely hereditary. We receive it from our ancestors, we share it with others; it is common property. There is another life which is our own. There each stands in the presence of his own Sinai, receives the Tables of Law of his individual life. To him there comes a Decalogue of private interpretation and the command—"See that thou do all things after the pattern thou didst see on the Mount!" So indeed must he work—if the world is to be better by a feather's weight for his life in it;—so must he build, quarrying his hereditary nature, polishing it for his individual structure. Nor shall he pause to ask whether the edifice is to be completed and adorned, and, labor give way to happiness. He cannot reach the great end, because there is no end; the scale is infinite; so have the poets said who reached the seeming summit, only to behold a higher height rising before them ever more. Let it be enough for each that the genius of God finds no obstruction in him; that he is part of the organizing force of the universe—as much as the coral building in the sea, the sun that vitalizes a world. And when the day is past and his bit of work is done, the ideal he has served will whisper a sweet and secret joy—"Thou hast labored, and others will enter into thy labors."

How truthfully this applies to us! Is this not an expressive keynote to govern us and to dispel the chaos in which we find ourselves? Does it not formulate the ideal for the future of medicine—a solution as to the part each must assume?

Our science has made rapid progress. The public perceives the power we possess to conserve and prolong its physical well-being. Knowing, it demands the benefits of that power. No individual can become expertly proficient in the application of all scientific knowledge. The average lay individual cannot afford to purchase these benefits unless we correlate the cost with his ability to pay. His love for his offspring may cause him to incur a single sacrifice, the result of which will bring him greater disaster than the occasion involves, and assume an obligation beyond his financial responsibility. He will not do so repeatedly at the cost of his independence. It is when we compel such repeated sacrifices that he will through his legislators demand that the state grant to him that which we make it impossible for him to secure. It is for us to make available to the average layman professional services that will protect his physical welfare and at the same time provide for ourselves emoluments that beget to us and ours a competency which will provide life's comforts and joys. Veritably a stupendous problem fraught with potential eventualities, still, not impossible of satisfactory solution.

When we individually and collectively fail to meet the ideals and demands of the public, we relinquish our right to its trust and confidence. Sordid, commercial ambitions seek to cause us to forfeit the people's confidence. Are we to develop solely as commercialists, worshiping at the shrine of dollar idolatry, the size of our golden calf the index of our attainment and skill? Or shall we continue as true votaries of our science, with the welfare of our fellow-man as our first consideration, with personal reward and independence a co-incidental factor of our humanitarian services? We are pressed for the answer.

The world upheaval of but a few years ago is still manifesting itself. We have not accomplished our readjustment. As a profession, in company with all other scientific groups, we have been drawn in the maelstrom of social and commercial confusion. It is little to be wondered that there has been much discussion of various forms of state controlled medicine and cult practices, that seek to bring about a new relationship between physician and patient. Such propaganda is but the bubbling gases escaping from the fermenting process. Effervescent in theory and nature, they may momentarily arrest progress, divert our purpose and cause a feeling of apprehension. We have lost sight of principles. We have been unnecessarily concerned with details.

Compulsory Health Insurance will not and cannot become an American institution. The freedom, temperament and culture of our people will not tolerate it. The domiciliary right of the American home will not countenance the violation of its precincts by the invasion of statute created authority assuming to minister to the flesh and blood of the father and mother, the heads of that home. I have no fear or concern that such a state of affairs will come to pass. My greatest concern lies with the physician, surgeon and specialist of

today and their followers of tomorrow—concern as to how they are going to measure up to the new state of affairs that is to be, how they are going to acquit themselves of their new responsibilities, and concern as to the ideals that they will erect to govern and inspire them. Upon that principle does our future rest. "An age deficient of idealism has ever been one of immorality and superficial attainment, since without the sense of ideas, nobility of character becomes a rare attainment, if possible." (Alcott)

The day of the individual doctor in the light that we have known him, has passed. Group practice of medicine succeeds him, except in certain instances. Community clinical centers must and will be provided. We must, on our own initiative, organize these groups and organizing them demand that our national, state and county medical organizations shall supervise and censor their activities and conduct. A code of ethics was formulated by our elders for their and our guidance. So must we formulate the new ideals that shall govern these groups of medical men. We must revamp, revise and add to that code of ethics so that through its precedents we shall conserve our present distinguished position, acquire renewed public confidence and establish a leadership in state and nation in all matters pertaining to the health and physical welfare of the people. Therein lies our future stability, the future of the medical science, its practice, hopes and aims. While wearing the mantle of science we cannot worship in the temple of gold. The caduceus cannot be cast aside and in its stead the money pots of Midas be accepted as the emblem of the medical profession's integrity.

It is your definite responsibility, as members of a special organization of radiologists, to contribute that constructive support to those whom you delegate as officers of your American Medical Association. A specific task is yours in the accomplishment of the solution of the problem. The degree with which you acquit yourselves in conjunction with your confreres, will determine the future of medicine and the ideal to be sought. Let us ever remember that what is stirring the world's heart, changing the face of the times and representing the form and working of the age is that intelligence, that sentiment, those thoughts and opinions, whose written and spoken word is power. That power is ours, providing we formulate an acceptable ideal that will impregnate the activities of our associates in the readjustment of medical contact with the people who compose our constituency. Frederick C. Warnshuis, M. D., F. A. C. S.

Grand Rapids, Michigan.

****Response delivered at the Annual Banquet of the Radiological Society of North America, Chicago, December 7-8-9, 1921.**

Corresponding Members

THE following men were elected to corresponding membership in the Radiological Society of North America, at the annual meeting held in Chicago, December 6, 1921:

Dr. R. Gilbert Scott—London Hospital, London, England.

Dr. R. W. A. Salmond—O. B. E., 51 Wellback St., London, W. I.

Professor Wintz—Director Frauen Klinik, Erlangen, Germany.

Professor R. Ledoux-Lebard—23 Rue Casimir-Perier, Paris, 7 e. Arrt.

Professor F. Dessauer—University of Frankfurt, Frankfurt, Germany.

Dr. A. E. Barclay—Kersal, Manchester, England.

Prof. Claud V. Regaud—Director Institute of Radium, Argentières (Haute Savoie), Paris.

Costa Forsell—Stockholm, Sweden.

These men, because of their position in the field of radiology, will contribute matter of vital interest to our readers. Through them we will be kept in constant and intimate touch with everything of professional interest in their several countries. The Journal considers itself fortunate to have secured contributors of such note.

Gold Medals Awarded

THE constitution of the Radiological Society of North America provides that gold medals shall be awarded to radiologists who have rendered especially valuable service to the profession in a scientific way.

At the annual meeting held in December, gold medals were awarded to Hollis E. Potter, M. D., Augustus W. Crane, M. D., Lewis Gregory Cole, M. D., and H. Kennon Dunham, M. D.

Dr. Potter was given the medal because of his work in devising the movable Bucky Diaphragm, technically known as the Potter-Bucky-Diaphragm. This instrument has proven of inestimable value in cutting off secondary rays from the plate when making exposures through the thick parts of the body.

The work for which Dr. Crane was honored was that done upon diseases of the heart. It will be recalled by many that he devised a method for making tracings of the movements of the different chambers of the heart. These tracings are made by the use of the x-ray and give practically the same information as that gained from the electrocardiograph.

Dr. Lewis Gregory Cole was honored with the gold medal because of his valued work on x-ray diagnosis of the stomach and duodenum. Not only is he a pioneer in the x-ray diagnosis of the diseases of the gastro-intestinal tract

but he has continued to add new material as time goes by. He has been one of the few men in this specialty who has taken the time to check up his x-ray findings at the operating table. This has given him a keen insight into pathology as revealed on the x-ray plate which is equaled by few and excelled by none.

Dr. H. Kennon Dunham was awarded the medal because of his contribution to the knowledge of pulmonary tuberculosis as revealed by the x-ray. He has spent much time in checking up x-ray findings in not only gross pathology as revealed at the postmortem room but has traced these findings as revealed by the microscope and has compared them to the normal histology.

Honor Men

IT is a constitutional provision of the Radiological Society to confer honorary degrees upon men chosen for outstanding work in the field of radiology. These may be physicians, physicists, or others who have distinguished themselves by some work related to the specialty. At the annual meeting held in Chicago, President Williams conferred the honorary degree upon George Edward Pfahler, M. D., William Duane, Ph. D., Professor of Biophysics, Harvard University. Dr. Pfahler was so honored because of his pioneer work in x-ray and radium therapy; Professor Duane, because of valuable work on the measurement of x-ray and the effect of different voltages and filters in the production of short wave length x-rays. It is upon the foundation laid by the physicists that the clinicians build the superstructure of therapeutic and diagnostic results.

Errata

IN the January number of the Journal of Radiology the article entitled, "Homogeneous Radiation of the Chest," by Dr. A. W. Erskine, the following mistakes were made, due to the fact that the author for his own convenience had entered certain notations on the manuscript showing the equivalent centimeters in inches.

Page six, line six, four centimeters should read ten; line fifteen from the bottom, first column, four should read ten. Twelfth line, from the bottom, eight should read twenty; eleventh line, sixteen should read forty; second column, sixteenth line from the bottom, sixteen should read forty; fourteenth line should read twenty-five; bottom line, sixteen should read forty; third column, twentieth line from the bottom, four should read ten; eighth line from the top, six should read fifteen; seventh line from the bottom, four should read ten; fourth line from the bottom, two and one-half should read six; second column, eleventh line from the top, sixteen should read forty.



DEPARTMENT of TECHNIQUE

Something New in Deep Therapy Installation

A. F. TYLER, M. D.

Omaha, Neb.

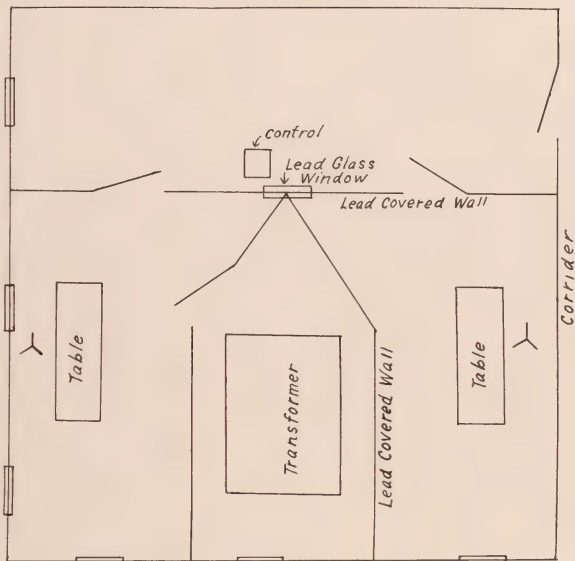
AT this time when many are planning the installation of high powered deep therapy equipment, suggestions from varied sources will not be amiss. The following is the floor plan of my deep therapy department as now operated. This department is in a hospital so that all classes of patients can be treated. Many of those coming to such a department are bedridden.

In addition to the usual complete history and physical examination of each patient presented for deep x-ray therapy, the following laboratory tests are made: urine analysis, complete blood count, blood Wasserman and where possible, microscopical section of the tissue to be treated. The patient is hospitalized while these examinations are being made and is thoroughly alkalinized. The treatment is then given according to technique planned carefully beforehand and based upon the thickness of the part to be treated. Immediately after the treatment is completed, another complete blood count is made and the alkalization is continued.

It will be seen from the illustration that the floor space is twenty-four feet square with an entrance from the corridor near the north side. The room itself is then divided by a lead covered partition extending from east to west, eight feet from the north wall. That portion of the floor south of the partition is then subdivided into two treatment rooms and a transformer room. The transformer room is placed between the two treatment rooms and has the walls brought to a point at the center

of the lead glass window. This arrangement makes it possible for the operator who is north of the lead covered wall to watch both patients and the machine at the same time. Two patients can be treated simultaneously, the high tension leads passing from the trans-

former over the walls of the transformer room which are only six feet high, directly to the tube in each treatment room. The window in the middle of the south wall is fitted with an electrically driven exhaust fan which keeps the air fresh and free from noxious odors.



NEW EQUIPMENT

A Manometer and Flow-Volumeter for Transuterine Peritoneal Inflation to Determine Patency of Fallopian Tubes in Cases of Sterility

A new apparatus devised by Dr. I. C.

Rubin for peritoneum work measures the quantity and the flow of oxygen or carbon dioxide gas used in insufflating the uterus to test the Fallopian tubes for patency. A manometer of the "tycos" or mercury type is combined with it, allowing for pressure reading at the same time as the gas flows. It does away with the necessity of first displac-

ing water from another vessel at a certain rate of flow to estimate the volume of gas. This at best was only an approximate estimation.

In this apparatus the pulsating type of water displacement meter is used. It is adapted from the well-known chlorine control apparatus employed by the firm of Wallace & Tier-

nan for water purification by the process of chlorination. The meter is of glass and is therefore non-corrodible and consists of an inverted glass siphon within a cylindrical glass meter. The latter is calibrated to a given capacity, as a rule 40 cc. It is hydraulic in principle, scientific, accurate and dependable. The upper end of the glass cylinder is attenuated to a narrow tube to which rubber tubing is attached to convey the gas from its

source. The lower end dips down into the water contained in the large glass tube or jar of convenient size. This glass tube or jar is provided with a rubber stopper perforated at three points, through one of which the narrow end of the volumeter passes. Two separate glass tubes pass each into the container to just below the lower limit of the stopper. To one of these the pressure gauge is attached and to the other a piece of rubber tubing for the outlet of the gas. To this piece of rubber tubing the intra-uterine cannula is attached. A spring relief valve may be provided which works automatically, or in lieu of this a needle valve is placed in the course of the outlet tubing. This latter is found effective and easy to handle. The spring valve is regulated to blow off at a pressure of 250 millimeters of mercury. While this can be dispensed with it is an aid and is well combined with the needle valve relief. For the convenience of those who do not care to take the trouble of doing this a siphon meter and glass jar with outlet and inlet connections blown in one piece and attached to a mercurial manometer, can be obtained.

The operation of the siphon meter is as follows: View X shows the water level 2 in the meter at the beginning of the pulsation and view Y shows the water level 2 just before the siphon C-G breaks at D, which completes one pulsation of the meter. When the downward flowing gas in A reaches the point D, it will rush up through the tube G of the siphon, and the bell or compartment B will refill with water up to the upper end of C. This completes one pulsation or measure of the meter, and the amount of gas delivered by this one pulsation is, of course, the capacity of the compartment B between the points F and D. The siphon meter used has a capacity of 40 cc. The amount of gas flowing may be determined by counting

the number of pulsations of the meter per minute.

For the purpose of determining the patency of the Fallopian tubes four pulsations delivering 160 cc. of gas are all that are required. In thin individuals from two to three pulsations will suffice to produce in the patent cases the subphrenic pneumoperitoneum which will be clearly seen with the fluoroscope. The pressure reading is of considerable importance, and the rate of flow is best regulated previous to a rise of 100 millimeters within 15 seconds. This can be determined readily by pinching the outlet tubing as the flow is regulated till it causes a rise of pressure to 100 mm. mercury in 15 seconds time. A ratio of 10 seconds to 100 mm. will also be satisfactory, but in the non-patent Fallopian tubes, where the matter of pressure is of somewhat greater importance than in the case of patency, it is better to have a slower rate of flow, i. e., the 15 seconds to 100 mm. mercury.

With this rate established (and this is done in a few seconds) the gas is allowed to pass through the volumeter and thence through the outlet tubing and cannula into the uterus. The needle valve is released until the cannula is inserted well into the uterine cavity beyond the internal os when it should be shut, making the system air-tight. Almost instantly the pressure rises at the rate pre-determined and will vary somewhat in cases of patency. The pressure required to overcome the resistance of the uterus and tubes where there is no tubal obstruction to the free passage of the gas will vary between 40 and 100 mm. When reaching these points it will fall sharply or slowly or even fluctuate about them. Occasionally the initial rise of pressure in the patent tubes will be higher, reaching 160 before it drops. The significance of this will be taken up in another communication.

In the non-patent tubes the pressure rises steadily to a point well beyond 200. It is

not necessary to carry this beyond 250 mm. because in all the cases so far examined this pressure was found to indicate occlusion. When, as occasionally happens, the gas will go through after reaching a pressure of 200 mm. in 15 seconds. Dr. Rubin has used a slower rate of flow in many cases, particularly in the non-patent cases where it is desirable to check up the finding of the first examination. This can be done during the same sitting when the flow is retarded, so that it requires 20 to 30 seconds to raise the mercury column to 100 millimeters.

While the apparatus has been assembled for the transuterine peritoneal inflation to determine the patency of Fallopian tubes in cases of sterility, it may be used to advantage in the direct transperitoneal inflation by abdominal puncture. The pressure gauge is in the latter case not so important but it provides an accurate volumetric measure of the gas introduced into the peritoneal cavity. The flow being visible through the volumeter, it may be stopped at any point when a desired amount has been given. The number of pulsations would have to be increased to say, 12 times 40 cc. or 25 times 40 cc. depending upon the amount of gas that one desires to introduce into the peritoneal cavity.

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Thus far the apparatus has been used in 225 cases out of a total of 350 insufflations and has given complete satisfaction.

Dr. Reuben Peterson collaborated with Dr. Rubin and offered many valuable suggestions in developing the finer details of the technique and in checking up the work. To him came the happy thought of combining the transuterine with the transperitoneal methods of producing artificial pneumoperitoneum, and in his hands the method has become established as a valuable adjunct in gynecological diagnosis.



ABSTRACTS and REVIEWS

The Campaign Against Cancer. By Francis Carter Wood, M. D., Director of Crocker Institute for Cancer Research. *Journal of Cancer Research*, September, 1921, p. 261.

FOUR things have led to the present public interest in cancer: increase in recorded frequency; dissatisfaction among surgeons with the results of operative treatment; effects of the publicity campaign against tuberculosis, and widespread propaganda concerning radium and roentgen rays in treatment.

Progress is now being made under three heads: publicity, experimental investigation, and improvement in methods of treating.

The Society for the Control of Cancer is one of the foremost agents in the publicity campaign having committees in all the states and larger cities to help in the work of educating the public and fighting the quack.

Animal experimentation on white mice and rats has proved the following: that massage spreads the lesion, that cutting a piece out for microscopic examination does not necessarily spread the disease. The exact amount of radium necessary to kill a cancer cell in a given length of time has also been determined. It has been shown that neither x-rays nor radium can kill all cancer.

What the future development of radiation therapy will be is not possible to prophesy. The author thinks lympho-sarcoma, basal cell tumors of the skin of the face, and carcinoma of the cervix may ultimately be transferred to the radiotherapist and possibly a ten per cent permanent cure may be expected.

The claim that fifty per cent of carcinoma of the cervix can be cured without distress is not to be accepted.

He advises prompt surgery in all operable metastasizing tumors and radium and x-ray for palliation in inoperable cases.

X-ray Dermatitis. By Mary L. H. Arnold Snow, M. D., New York City. *Medical Record*, Nov. 26th, 1921, p. 927.

DERMATITIS or sequelae conditions may result from treatment in any practice where the x-ray is operated by a novice or one unskilled or careless in technique. Factors in the production of undesired effects are: lack of adequate protective apparatus or filters, the strength of the rays including their cumulative effect, the proximity of the tube, the duration of the treatment, including repetitions, the patient's susceptibility and idiosyncrasy. Scattered or vagrant radiation must not be ignored as it is of the same penetration as the original beam.

Witherbee warns against the "overlapping of the areas exposed" and, to avoid burns from a patient going from one laboratory to another, advises the use of an x-ray chart which includes a record of spark gap, milliamperage, time, distance, number of exposures, date of last exposure, and patient's position. The time for erythema to appear—ten to fourteen days—and to disappear, about two to six weeks, must be kept in mind.

The rays have a cumulative effect. Dermatitis may follow a single exposure with improper technique, or it may follow a number of moderately heavy exposures covering too long a period of time. It is apt to follow one or a few heavy exposures. If raying is combined with fluoroscopic dermatitis may follow too long exposures. In radiatherapeutic practice it is apt to follow fractional doses covering weeks and even months or follow-

ing too heavy doses repeated at too short intervals. Dermatitis has been reported as occurring from fifteen minutes to nine months after treatment. These extreme cases were accompanied by ulcerations.

Cases that have been exposed to artificial freezing, fulguration, or any process lessening the vitality of the part call for precaution.

Thirteen to fifteen inches from the target is the minimum distance for safety.

The idiosyncrasy of the patient must be taken into account, opinions to the contrary notwithstanding.

Registrable x-ray evidence of pathology invading the human body will be manifested as a variant from the normal.

An x-ray dermatitis is similar to any other when beginning and is apt to pass unnoticed by the novice. It is well to ask the patient to notify you of any erythema appearing upon bathing as it is more apt to be noticeable then. A slight itching is usually the first symptom noticed by the patient. Freckling or tanning may be symptoms. Dermatitis may be acute or chronic.

Beck describes the condition as having three degrees—"The first is characterized by hyperemia, infiltration, increased temperature, exfoliation in small scales . . . with itching. The main feature of the second degree consists in the formation of blisters . . . the third and gravest degree is characterized by the escharotic destruction of irradiated tissues. They show the signs of dry gangrene and appear brownish black . . . a granulating ulcer remains, the cicatrization of which may take months."

Freckling may last a long time, likewise tanning, though it may disappear in a few weeks. Hair regenerates in from four to twelve weeks, nails in the course of a few months. The latter react to the rays very quickly. (A second paper is to follow.)

The Treatment of Advanced Carcinoma of the Uterus by Radium. By Arthur Burrows, M. D., London. *Brit. M. J.*, Oct. 1, 1921, p. 524.

THE author takes up the treatment of advanced uterine carcinoma only.

One of two methods, neither of which so far seems better than the other, is used by him. There is no necessity for the heavy metal screening that has been employed. In no case need a screen thicker than one millimeter of silver be employed, unless in the administration of huge doses such as are used at John Hopkins.

In the screened method about seven tubes are inserted under anesthetic. A large one of about fifty millicuries of emanation (about fifty milligrams of radium element) screened by one milligram of silver is introduced well up into the cervical canal. Six other smaller tubes, screened by three-tenths mm. of brass are pushed into or about the cervical growth. The strength of each of these is about fifteen millicuries. A dose never less than one hundred and twenty millicuries must be given for twenty-four hours.

In the unscreened method the large central tube as above is used but small unscreened capillary glass tubes, each containing radium emanation of a strength of two to five, and sometimes seven, millicuries, are inserted in the surrounding tissues. The large tube is removed after twenty-four hours but the smaller ones are left in.

With strict cleanliness there is no danger in either method. Douching is performed.

daily after the operation to keep the reacting growth clean and to prevent adhesions.

There appears to be considerable possible variation in the quantity of radium employed, time of application, and screening used.

Some extremely advanced cases must be left alone and the outlook is not good in cases where the growth is very large and hard, or where there is an infiltrating growth in the vaginal wall. Cases just beyond operability are the most hopeful.

The patient in a "symptomatic cure" should feel perfectly well and be free from pain and discharge. The uterus should be quite mobile, the cervix small and smooth, and any scar tissue should be soft and supple.

Of a hundred cases treated between April, 1916 and July, 1918 the results are tabulated as follows: six are still definitely well; five were well one year after treatment but could not be traced after that; seven were well three to six months after treatment and have not returned; six were rendered operable; thirty-two were rendered comfortable and able to work from six months to two years, though some of these have since died; twenty-six were either not improved or died quickly; sixteen could not be traced for any length of time; two were given prophylactic irradiation.

Apart from all facts given above radiation treatment for palliation alone would be well worth while.

Pre-Operative and Post-Operative Radium Therapy: Report of Cases, Dosage and Methods. By Ben R. Kirkendall, M. D., Columbus, Ohio. *The Ohio State M. J.*, Dec., 1921, p. 837.

DR. Kirkendall's experience with eight hundred and seventeen cases, during a four year period, covering cancer of the mouth, rectum, cervix, uterus and adnexa, also cancer of the bladder, kidney, prostate, ovary, vagina and the colon is here recounted.

Fifty-three of these had cancer of the mouth, treated after surgery. Thirty are still living, six of whom are unimproved, twenty-seven improved for periods varying from three months to a year. Nineteen were free from disease for a period varying from six months to three and one-half years. One could not be traced.

Twenty-two were treated for cancer of the rectum. Six of these were post-operative cases. Three were not improved, one has been free from disease for a year, one for nine months and nine are still living. Colostomy first seemed to bring better results.

There were fifty-six cases of cancer of the cervix, twenty-nine were operated on before radium treatment. Forty-two are still living, thirty have been free from disease for periods varying from six months to four years.

One hundred and twenty-four cases of cancer of the uterus were treated. Sixty-five were post-operative cases, that is radium had been used directly after operation and in twenty others operation had preceded treatment some little time. Fifty-nine are still living but this is not given as a final report for some have been treated only quite recently. The use of the cautery before treatment is advocated by the author.

Of the other pathology treated the best results were secured with cancer of the prostate (nineteen cases, seven post-operative) and in cancer of the colon of which three cases, all post-operative were treated. A report on cancer of the breast will be given this year before the American Radium Society.

The dosage for cancer of the cervix and uterus is practically the same. Within a week's time three applications of radium into the cervix are given, fifty to one hundred milligrams of radium at one time are used with eight-tenths mm. of brass screening and black rubber covering for a total dosage of 3500 or 3600 milligram hours. The application is made over night every other day, preceded by a soap suds enema and the bladder kept empty with a catheter.

Cancer of the rectum is given from one to two twelve hour doses, with fifty milligrams of radium in a brass screen with several layers of gauze and rubber around it. One twelve hour treatment in a month's time is given again if necessary.

In cancer of the ovary, or in a case of abdominal metastasis, a heavy black rubber tube with a closed end and perforated side is inserted into or around the growth, and fifty to a hundred milligrams of unscreened radium on wires is lowered into this tube for direct application. A dose of from four to eight and even twelve hours duration has been given with impunity. If the growths are extensive the radium is moved to a new location by shortening the wires and bending the ends over the rubber tube to hold them.

In cancer of the bladder and prostate when there has been a supra-pubic drainage performed unscreened radium is lowered into the bladder to the growth and left from six to eight hours.

In cancer of the mouth radium screened with brass is used, or is used unscreened except for rubber. Fifty to a hundred milligrams of radium given six to eight hours are given according to the lesion.

All sarcoma cases are treated with radium needles or with the implantation of radium tubes. Over forty sarcoma have been treated by the author but the time limit did not permit a report of these in this paper.

The following conclusions are drawn:

1. Cases of carcinoma of the vagina and prostate are best treated with radium alone.
2. Cases of cancer of the cervix and uterus which have responded well to the treatment should rarely be hysterectomized later, as distant quiescent disease cells may be stimulated to recurrence.
3. Radium can be used before surgery to make non-surgical cases surgical.
4. Radium after surgery may make a success of the operation.
5. Its use in recurrences is palliative but it may cure also.

A Histological Study of the Effects of Radium on Carcinoma of the Cervix. By Charles C. Norris, M. D., and Norman S. Rothschild, M. D., Philadelphia, Pa. *Am. J. Roentgenology*, Oct., 1921, p. 604.

THE clinical and pathological classifications are first considered. The condition has three stages: a hard nodule in the substance of the cervical lip; a circumscribed, indurated ulcer of the portico or cervical canal, and a non-diffuse low papillary outgrowth covering a portion of the lip or canal. Other classifications are: induration with loss of tissue; disintegration, and excavation. Still another is divided into advanced, borderline, and early.

Pathologically, two types are found: the squamous cell carcinoma of two varieties, the basal cell and prickly cell, and the adenocarcinoma.

Many factors are concerned in the effectiveness of radium on malignant growth. Some cells may be radio-receptive, others radio-refractory. During mitosis the cell is more sensitive than in the resting stage. Immature, undifferentiated and embryonal cells possess a great affinity for radium while mature cells and tissue have but slight affinity. The for-

mer cells are destroyed by a dose that would produce but little change in mature cells.

Bergonis and Tirbondeau believe cells vary in their reaction according as they are fixed or not in their morphology and function; for example, a neuroma is much more sensitive than a normal nerve, spermatozoa are much less sensitive than the cellular layer they are developed from and all highly specialized cells have a low radio-sensitivity.

In normal tissue a slight exposure acts as a stimulant to the tissue producing congestion which is followed by increased formation of fibrous tissue. If the exposure is prolonged or the infiltration is insufficient the action is caustic and an acute inflammation results, which may even go on to necrosis and sloughing of tissue. If the exposure has been accurately calculated the inflammation will slowly subside and the deeper tissues will participate in a diminishing ratio according to their depth. In all there is an inflammatory condition with a leucocytic migration and an invasion of small round cells. Fibrous tissue formation is the next stage and the newly formed tissue with its capillary blood vessels may surround individual cells or areas of cells. By subsequent contraction of connective tissue the blood supply to these tissues is diminished. If rapid occlusion takes place necrosis will follow quickly, but if more gradual, atrophic changes may follow.

There are five stages in the histological effects upon malignant tissue, these are: the stage of acute inflammatory reaction lasting one week; stage of early nuclear and cytoplasmic changes, in which mitosis often ceases, lasting likewise a week; stage of intercellular changes in which infiltration of the malignant cells by young fibroblasts takes place; the stage of destruction starting with the fourth week and continuing to the ninth. In this stage the nuclei of the malignant cells may be broken up into chromatin masses or may shrink and cytolytic takes place. The cancer cells show numerical reduction and the fibrous overgrowth is conspicuous. In the fifth and last stage the cancer cells appear as compressed bands in the fibrous stroma and only the small contracted nuclei remain. At a later period no trace remains of the malignant cells. There is, of course, a blending of these stages.

Finzi believes the production of the connective tissue is the essential feature in the death of the malignant cells. Frank believes the rays cause the connective tissue to contract, with obliteration of the vessels and lymphatics and starvation of the malignant cells.

Several others have observed cellular changes preceding the fibroblastic injection. The author believes the effect of the rays causes cessation of mitosis, destruction of nuclei, cytolytic, and ultimate destruction of the cells.

Extra Bones in the Wrist and Ankle Found by Roentgen Rays. By A. Howard Pirie, M. D., Montreal, Canada. *The American Journal of Roentgenology*, Oct., 1921, p. 569.

CERTAIN extra bones in the wrist are frequent, others moderately frequent and still others very rare.

In the foot the os trigonum, the tibiale externum, secondary os calcis, os peroneum, and one other without a name are fairly common.

In the hand the os centrale and the os triangulare are moderately rare.

Often in case of fracture this knowledge is of value in avoiding mistakes and often it has a medico-legal interest.

Some of these extra bones are explained by comparative anatomy but a more general explanation is the one founded on the embryology of the bones. Fusion sometimes does

not take place and an extra bone is thus formed. Sometimes however these extra bones will be found fused to other bones. An extra long styloid of the ulna is caused often by the fusion of the os triangulare to the tip of the styloid.

Sesamoid bones are in the same class as extra bones, have no function and are where they are in order to get them out of the way.

There are about twenty extra bones found in the wrist. The last edition of Quain's Anatomy gives the full list. The author has had experience with six of these.

One illustration shows the os magnum with a projection on it which represents the os centrale fused to the former bone. This bone is found constant in monkeys as one of the bones of the wrist.

The os triangulare is found in sixty-five per cent of second month embryos but is rare in the adult. It is a perfectly formed little bone like a sesamoid and can be confused with a fractured styloid which will have a rough edge, though this rough edge may have disappeared in an old fracture and the styloid be deformed.

If an extra bone is suspected an examination of both wrists should be made for the extra bone will usually appear in the other wrist also.

The ulnare externum is a rare bone. One illustration of it is given lying between the fifth metacarpel, the unciform and the cuneiform.

The radiale externum is the end of the tubercle of the scaphoid, is quite general in mammals except man.

The appearance of the scaphoid in roentgenograms is more varied than any other bone of the wrist. Diagnosis of divided scaphoid is justified if it is found divided in both wrists. Usually when it appears divided it will be found that it is due to a fracture.

Thickenings inside of normal bones may give the appearance of extra bones but stereoscopic examination will usually make this clear.

In the foot the os trigonum is shown in seven to eight per cent of roentgenograms of the ankle. It is in reality the posterior external tubercle of the astragalus. It may be short and stout or long and slender.

The secondary os calcis is a small bone found in the angle between the os calcis, the astragalus and the scaphoid. It corresponds to the os centrale in the hand.

The tibiale externum is found at the tuberosity of the scaphoid. It is a constant bone in many animals and is found in the second month human embryo. Surgeons should be familiar with it as it gives the appearance of a fracture. It usually occurs on both sides and is commoner in women than in men.

The os peroneum is a common bone lying in the tendon of the peroneus longus, usually it is seen in the semilateral view between the os calcis and the scaphoid.

The os vesalianum is a very rare bone at the base of the fifth metacarpel and must be distinguished from a fracture. It was discovered nearly three hundred years ago.

The last bone described is nameless. It is not infrequently found at the posterior and upper part of the navicular. In one case it appeared fused with the scaphoid and in one with the astragalus. The author consulted the professor of anatomy in Edinburgh University who said he had never seen nor heard of this bone but afterwards reported its discovery in the dissecting room.

The author had special opportunities of examining roentgenograms during the war and so made a large collection of these cases.

Extra bones are best distinguished from fractures by comparing the bones of the opposite wrist or ankle.

Illustrations of all bones described in this article are given in the original publication.

Primary Sarcoma of the Vertebrae. By Karl F. Kesmodel, M. D., Walter Reed Hospital, Washington, D. C. *American J. of Roentgenology*, Oct., 1921, p. 572.

Primary sarcoma of the vertebrae is uncommon. Its detection is difficult, often missed, and often misinterpreted as tuberculosis of the spine. The presence of tuberculosis in the family should not legislate against the diagnosis of sarcoma as shown by two cases in the author's experience.

Neither must age be given undue consideration as sarcoma has been found from the age of one year to seventy.

History of trauma frequently is present. Pain is a prominent symptom. Anesthesia and paresthesia are noted. The sensation of touch and thermal changes may be absent in certain areas. Often there is a difference between the reflexes of the two sides. Oppenheim, clonus, and Romberg may be obtained. There is muscular weakness with ataxia and atrophy.

Positive Roentgenographic findings may be absent. No observable change in the outline or structure may be present, or if present not by any means characteristic. These changes are easily confused with those of tuberculosis. Owing to the irregularity of the destruction there is but little deformity in the vertical axis of the spinal column. Abscess formation is absent but invasion of the surrounding soft tissues may stimulate an abscess.

Sarcoma of the vertebrae must be differentiated from tuberculosis of the spine, spinal cord tumors, metastatic malignancy, fractures, syphilis, and typhoid. Tuberculosis attacks the joint early, destroying the intervertebral disc, whereas in sarcoma the body is first attacked, and the intervertebral space is affected but little. The abscess common in tuberculosis is absent in sarcoma.

Differentiation from primary tumors of the cord rests almost entirely upon radiographic findings. In sarcoma the lesion is primarily of the destructive type, in primary tumor the changes are due to pressure and the slow growing type will give a fusiform widening of the neural canal while the rapidly growing type will give a distinct widening in a specific region with some erosion of the inner margins where the tumor passes out of the canal.

In metastatic malignancy the lesion is multiple and the primary lesion can usually be demonstrated. The location of metastasis in the individual vertebra is central, whereas the primary tumor usually appears at the margin.

In fractures there is usually a history of severe trauma, the deformity is of the compression type and there is no evidence of bone destruction. Should a fracture occur at the site of the tumor, the true lesion may be missed altogether.

Syphilis and typhoid of the spine can usually be ruled out by history and laboratory tests. The process in these cases will often be accompanied by proliferative changes, bridging or actual ankylosis and other evidence of repair which will be absent in neoplasm.

Histories of four cases with illustrations are given. These were all proved at operation.

The author draws the conclusion that primary sarcoma of the vertebrae is not a common lesion and that when it does occur it is very easily confused with Pott's Disease. It may or may not give roentgenographic evidence of its presence. Repeated roentgenographic examinations showing rapid destruction of the bone with little involvement of the intervertebral discs are necessary for true diagnosis.

Squamous Cell Carcinoma of the Antrum.

Report of a Case Treated With Radium Alone and Free From Recurrence Twenty-two Months After the Last Application. By J. Harper Blaisdell, M. D., Boston. *Boston M. & S. J.*, Nov. 10, 1921, p. 570.

THE author calls attention to the Mayo Clinic having abandoned the removal of

the upper jaw in favor of a method combining the cautery and radium. The inside of the antrum comes away as a sequestrum in about two months time after the use of the cautery.

The case treated by the author with radium alone was squamous cell carcinoma of the left antrum developing after a moderately painful alveolar abscess which followed in the wake of a gauze dressing left in a tooth socket after extraction. Decaying snags and pyorrhea had preceded the extraction at which time a pledge of cotton had been found at the end of the root canal.

The patient's cheek was badly swollen, the growth was large enough to push the nose over to one side considerably. The shape of the palate was not altered. There was obstruction of the nostril on the affected side and discharge from it.

Fifty milligrams of radium element, screened with 0.5 millimeters of silver and one millimeter of brass was introduced by way of an incision made through the canine fossa. This was left in place for twenty-four hours. Slight reaction to the radium and relief of swelling, pain and tenderness were the immediate symptoms. Thirty-two days later fifty milligrams of radium were introduced.

Three weeks after this treatment the patient's sufferings began to be extreme. Loss of teeth, sloughing of the hard palate and the alveolar processes took place. The patient's mental processes were dulled markedly, his loss in weight was fifty pounds. During the last month of this three month period he was confined to bed and his death deemed inevitable. Finally a large mass of sequestrum came away and from that time on improvement was very rapid.

Complete removal of the antrum and its surrounding structures was made, the normal tissue healed rapidly and the patient was back at work in a few weeks. Twenty-two months after the second treatment he is vigorous as ever. There is a thickness of speech and some difficulty in eating but for the present he declines any help for this.

Some Criteria of X-ray Diagnosis. By Frederick W. O'Brien, M. D., Boston. *Boston M. & S. J.*, Nov. 17, 1921, p. 591.

THE criticism made of x-ray diagnosis by certain eminent men is partly due to the following causes: the commercial development of a certain type of x-ray apparatus; lack of appreciation of certain criteria in x-ray diagnosis; faulty methods; failure of consultant and roentgenologist to cooperate; and a misapprehension of the limitations of x-ray in relation to final diagnosis.

The development in apparatus is compared to that in surgical instruments. Just as the electric trephine is a boon, when directed by competent hands, so is the small transformer; but in the wrong hands dangers far exceeding those accompanying old methods accompany each.

Any layman may learn to make good x-ray negatives by rule of thumb but the technician lacks the medical training and intuition to accomplish what the roentgenologist can. And the physician's interpretative work is limited value until he has had special training in roentgenology. In spite of these facts some recognized hospitals employ laymen to do not only technical but interpretative work. The technician has a place but should never be allowed to work without the direct supervision of the thoroughly trained and experienced roentgenologist.

As to method employed in diagnosis the competent roentgenologist knows that there are limitations to both fluoroscopic and photographic methods and works accordingly. The roentgenoscope is applicable to areas showing

gross pathological changes but this method should not be used for lung and gastro-intestinal diagnosis regardless of its limitations.

Interchange of opinion with clinician, surgeon, or specialist is essential to well-rounded diagnosis.

Preparation of the patient is important and sometimes grossly neglected. The presence of food in the gastro-intestinal tract has been known to lead to very mistaken diagnosis.

Making one plate only is often worse than making none at all.

True economy for the patient will often consist in letting the roentgenologist choose his own method of examination.

When it comes to teeth the response of a tooth to the vitality test absolves it whatever roentgenographic appearances may say. Abscess cavities may be mistaken for pus sacs. Increased radiability does not always mean necrosis.

In lung disease, generally speaking, clinical as well as x-ray evidence must contribute to reliable diagnosis. Negative diagnosis is comparatively easy here but reliable positive diagnosis requires more care.

In some cases ruling out other possible pathology is a valuable aid to the clinician and should not be dispensed with, e. g., a suspected case of early, acute osteomyelitis.

In all diagnosis the author much prefers the term "no pathology recognized" to that of "negative." A "negative diagnosis" of gallstones, resulting from routine examination, is almost worthless.

Perspective with proper alignment, not smashing the camera is the author's avowed aim. X-rays should be employed universally and the diagnosis is proportional in value to the roentgenologist making it.

Important Points in Bone Surgery. By Joseph W. Walsh, M. D., Brooklyn, N. Y. *New York Medical Journal*, Nov. 16, 1921, p. 576.

NO branch of surgery is more difficult of performance than that of the bones and joints.

X-ray surgical diagnosis in structural bone diseases is an important aid to the surgeon as a guide before operation and a mentor after operation. The x-ray enables surgeons to see that end results of the closed method of treating fractures are often not all that could be desired; overlapping and shortening in the long bones often exist, poor alignment and angulation near the point of union occur, with consequent weakness and awkwardness in walking, resulting often in fractures of bones of the lower extremities.

Bone tumors are chiefly: exostoses, chondromata, fibromata, sarcomata, carcinomata and cystic tumors. Early radical operation is advised for all except exostoses.

The use of radium in malignant bone conditions has been advised, using a considerable amount of radium in lead tubes one-tenth to two mm. in thickness, in much the same way that MacDonald* used it for deep growths. He used two hundred and fifty mg. of bromide of radium in platinum tubes two and a half mm. thick, keeping the tube in the tumor and leaving it in place for forty-eight hours. A long application like this is not advised more often than every six weeks. The use of radium in any case should be after experience in its application and careful study.

One object of this article is to induce a greater appreciation of the value of the x-ray and its more frequent use in the treatment of fractures in their early stages, the stage of absorption before the formation of plastic lymph, when so many poorly reduced fractures can be brought to a position of proper reduction and apposition.

*MacDonald, *British Medical Journal*, Dec. 9, 1911.

Radium in Surgery. By W. S. Schley, M. D., New York City. New York Medical Journal, Nov. 16, 1921, p. 573.

RADIUM is applicable in surgery where used as an adjuvant measure. In some cases it can better accomplish a cure but there are regions where surgery, experience has shown, is better. Reference here is to epithelioma where the lesion involves the periosteum and bone.

In the capillary nevus radium has an exceedingly good effect. Brilliant results have been secured in the larger hemangioma. Keloid yields remarkable results if care is used.

Warts, keratoses, intractable eczema, and psoriasis have been successfully treated.

Inoperable carcinoma of the mouth, tongue, and pharynx, esophageal malignancy, rectal carcinoma, and carcinoma of the bladder and prostate can all be retarded by the use of radium. There have been some cures reported in all of these but cases of the stomach, liver and intestines can be only retarded by treatment. Improper treatment makes them worse of course.

Carcinoma of the urethra and contiguous part of the bladder has shown retrogression in a case under the author's care. Inoperable cancer of the uterus has been wonderfully benefited if not cured, but carcinoma of the vagina the author believes is not benefited. Many fibroid uteri react astonishingly.

Enlarged spleen has been treated with satisfying results.

Enlarged thymus in infancy and childhood and lymphosarcoma of the glandular system and mediastinum have been very successfully treated.

In operable breast cases and where operation is refused treatment produces very favorable systemic results.

Much harm has been done and discredit brought upon radium treatment by improper dosage. Under treatment as well as over treatment can produce harmful results. Radium has been used in cases that should have gone to the surgeon and the surgeon has operated cases that should have had radium and not surgery. At times radium should be used in preparation for surgery.

Its postoperative value is not to be gained. In failures the technic has probably been at fault.

In the use of radium therapeutically the first considerations must be: the different reactions in different tissues; different skin quality and texture for both superficial and deep application; length of exposure; quantity of radium salt or emanation and kind and quantity of filtration or screening; character of growth and location; form of treatment surface or implantation and from what direction; also whether to use massive doses or small and oft repeated doses.

Radium is in its infancy, not its old age. Surgery has been outcome in many instances. A closer relation should exist between all workers.

Biological Determination of Radiation Dosage. By Francis Carter Wood, M. D., New York City J. Radiol. Feb., 1922.

TO secure permanent results in the treatment of deep seated neoplasms with highly filtered rays much larger doses than previously used must be given. The dose which the skin receives must be terminated just at the point at which a slight erythema appears, or as some claim, just a little in excess of this. These statements are true no matter what type of machine is employed and no matter what voltage is employed.

Burns produced without a filter or with a low degree of filtration are not more severe than those produced by one using a thick copper filter and the highest voltage obtainable. With the former four or five erythema doses can be given in a few minutes while with the later hours are required to exceed

the proper limit of skin exposure although deeper burns will result from it.

Determination of dosage is of the first importance. Insufficient raying will stimulate instead of retarding tumor growth while too much raying may cause serious, even fatal injuries to the internal tissues and organs.

Previous methods of determination of dosage, when heavy filters of any metal are employed, are unreliable. A convenient and accurate method of determining the skin dose and the amount reaching the tissues much deeper down is the present need.

Present scientific knowledge makes possible the construction of an ionization chamber of such dimensions that it can be placed in contact with the tumor, if cervical, rectal, or prostatic, or under the patient if an abdominal or thoracic tumor, and direct readings in biological, not physical units be obtained with it. Such an instrument could be calibrated with a standard biological material.

It cannot as yet be considered absolutely settled that equal ionization doses are equally effective, no matter what the wave length of the x-ray.

The nearest approach to the biological standard now in use is the erythema dose. This dose varies with the individual and also with the portion of the body. Once obtained it is reproducible with the same x-ray apparatus under exactly the same working conditions, but each machine must be checked up upon a human being.

In the Crocker laboratories standardization is accomplished by means of a certain strain of mouse cancer. The method is recommended to all practicing deep therapy.

It is dangerous to assume that the proper carcinoma dose for human therapy is that resulting in the destruction of a subcutaneous metastatic nodule from carcinoma of the breast. Recurrence may occur. Also that cancer cells do not become immune to repeated rayings and inoculations has been proved by experiments with mouse tumor.

Only lympho-sarcoma and basal cell carcinoma are permanently curable with an approximate erythema dose—and they may show resistance.

Conclusions:

As the difference between a stimulating and an inhibiting dose for tumor cells is not very great, likewise that between the dose necessary to kill cancer cells and that which may cause serious injury or even death of the patient, it is extremely difficult to properly calibrate an x-ray machine for deep therapy.

Exact surface and depth dosage is therefore a necessary preliminary to deep therapy.

The mouse tumor (Crocker Fund No. 180) has shown no variation in its x-ray lethal dose during five years of study and furnishes the best means of calibration.

The lethal dose for this tumor for x-ray of any voltage and any filtration is approximately six erythema doses as measured by a skin redness after ten days on the most sensitive skin areas.

In comparison to human tumors it shows about the same resistance to x-ray as the highly malignant neoplasms of the intestinal tract which as yet evade successful radiotherapy.

The lethal dose for radium for this tumor being also known, it furnishes the means for biological comparison between the action of x-ray and radium and permits the estimation of equivalent dosage.

X-ray Studies of Mediastinal Shadows With Special Reference to Dermoid Cyst. By Max Kahn, M. D., Baltimore, Md. J. Radiol. Feb. 1922.

NEOPLASM is not infrequently found in the mediastinum. Aneurysm may be mistaken for it. Fibromata, chondromata and lipomata may be found but have never been demonstrated roentgenologically. Sarcoma is

more common than carcinoma. Metastasis frequently follows malignant sarcoma of the bone and may follow other types.

Primary carcinoma of the mediastinum arises from the mucous membrane of the esophagus or trachea, rarely from remains of the thymus. It may occupy one or both sides and often involves the lung and pleura. It is difficult to distinguish roentgenologically between primary and metastatic carcinoma, however, the shadows in the latter are usually more regular in outline.

Aneurysm may be distinguished by noting the expansive pulsation though care must be taken not to confuse a normal pulsation transmitted to adjacent parts.

Hodgkin's disease cannot be absolutely differentiated from lymphosarcoma by the mediastinal shadows.

Enlarged thymus may be manifested by a shadow in the anterior mediastinum.

Roentgenologically a mediastinal abscess has usually a sharply defined border, is fairly large, shadows are not as dense as neoplasm and no pulsation is visible.

Echinococcus cyst is very rare but may be present commonly in the right side in the region of the base, may be attached to the diaphragm, extending upward from the liver.

Dermoid cysts in the mediastinum vary in size from a walnut to that of a child's head, are usually spherical in shape but may be flattened.

Detailed report is made of a case of dermoid cyst of the mediastinum in a female patient fourteen years of age. Symptoms had appeared about four weeks previous to the examination. A dull pain and a swelling were noticed at the upper part of the sternum. Cough had been present for a week. No other very marked pathology was shown.

Roentgenoscopic examination showed a large rounded tumor shadow occupying the greater two-thirds of the right side of the chest. This shadow moved freely upon inspiration and revealed lung structure posteriorly and below. The liver shadow appeared depressed. It apparently was slightly attached to the diaphragm near the median line. No pulsation could be seen in that region. Upper right lobe and apex appeared clear and left lung also. Heart shadow was displaced well toward the left, the heart was slightly enlarged apparently and there was a marked gradual curving of the dorsal spine backward. This tumor shadow was thought to be due to a large dermoid cyst through an echinococcus cyst was considered also.

Operation was performed by Dr. Bloodgood. A cyst was found and opened; it contained thick yellow pus, granular debris and hair. Diagnosis: dermoid cyst. It rested upon the diaphragm and was slightly adherent to it; there were a few adhesions to the lung to the outer side and above the cyst. The larger portion of the cyst under the mediastinum could not be separated from the pericardium and the operation was abandoned after suturing a Brewer tube into the cyst. Drainage was rather free but post-operative course was unfavorable, pneumonia of the right lung developed and the patient died the third day after operation.

Post mortem showed that the cyst had occupied practically the entire space of the right lung, pushing it up into a very small space. The cyst extended from the mediastinum to the liver, to the chest wall and almost to the clavicle. It was very adherent in the region of the clavicle and so firmly attached in the mediastinum that it was not possible to separate it with the gloved hand. It contained a tumor mass about the size of an orange, irregular in outline, spongy, pinkish white, covered with short fine hair. Section studied microscopically showed an epithelial covering with hair follicles, sebaceous glands, sweat glands and hair follicles, below was subcutaneous tissue and fat. The cyst wall was

composed of dense fibrous tissue with no evidence of epithelial lining.

The cyst enclosing the tumor probably represented a reaction of the body in walling off the original dermoid tumor.

This case had received seven radium treatments during the time preceding operation. Dr. Bloodgood, in discussing the case stated that he believed it had been a mistake to operate so soon after radiation, also that failure to get a reduction in the shadow showed the lesion was not amenable to radiation and that the second radiation should not have given. He also stated that, though it might be a question whether the operation was a mistake, he had as far as possible used previous experience in deciding upon it.

Dr. Bloodgood also stated that in case of a mediastinal shadow radiation should be given irrespective of previous history and in a great majority of cases reduction of the shadow would follow which would indicate sarcoma as mediastinal tumor does not show this reduction. In the case operated Dr. Bloodgood had felt that it was unquestionably a case of carcinoma.

The Possibilities of Pneumoperitoneum in Gastro-intestinal Diagnosis. By L. R. Sante, M. D., St. Louis, Mo. J. Radiol., Feb., 1922.

THERE is no question of the efficaciousness of the present method of gastro-intestinal diagnosis. The problem is to detect where this method is weak and to determine whether pneumoperitoneum will be of aid.

Barium meal utilizes a medium of increased density while in pneumoperitoneum a medium of decreased density is employed, namely, gas. The use of the former in cancer in cases where lesions are present in the anterior or posterior wall of the stomach often fails to reveal the pathology.

In examination by pneumoperitoneum the stomach must be perfectly empty. It is wise to wash it out. The abdomen is then cleansed and painted with iodine and pneumoperitoneum is produced by inserting a lumbar puncture needle into the left lower quadrant. No attempt is made to sterilize or filter the air. Deflation at the end of the examination should be the established routine.

The patient, lying on his back, is examined before a vertical fluoroscope. The anterior stomach wall will be seen and also the peristaltic waves originating at the cardiac end and passing toward the pylorus. When the patient is rolled slightly to the left the pyloric ring and the first part of the duodenum can usually be seen.

On examination with the horizontal fluoroscope the stomach casts a shadow similar to the postero-anterior view shown by the barium meal examination. The use of barium meal in connection with pneumoperitoneum however is not of advantage.

In demonstrating tumors of the posterior wall of the stomach the patient must assume a prone position and be supported by a block beneath the head and also one under the thigh to allow the abdominal walls to sag thereby rendering the retroperitoneal structures visible. The vertical part of the stomach can be seen extending almost obliquely downward while the transverse portion bulges backward into the prevertebral space. The second and third portions of the duodenum may be rendered visible and diverticula should be easily localized. Tumors of the head of the pancreas can be shown in their relation to the duodenum but not better than in the barium meal examination.

Adhesions of the small intestines to the surrounding organs and to the abdominal wall are the most important lesions demonstrated by pneumoperitoneum. Intestinal obstruction, the result of old adhesions, does not show any better by this method but inflammatory lesions, the result of sub-acute peritonitis, are

easily recognized by this method since the intestines will be seen to be fixed—movement on the part of the patient not displacing them as normally would take place. No deleterious effects are noticeable in such cases following the use of this method.

The contents of hernia can usually be established without difficulty—either a gas filled hollow viscera will show or dense omental tissue. Excellent information is secured in cases of suspected malignancy, also in regard to the portion of the stomach involved in the hernia.

The normal appearance of the large bowel and the wide variation in movement of the cecum in different individuals must be kept in mind when making their examination. True pericecal adhesions can be distinguished from normal attachments of the cecum by the fact that any change of position which puts them on a stretch will cause distinct pain. In determining the extent of infiltration of carcinoma of the large bowel pneumoperitoneum is of great advantage but it cannot be used for detection of the primary growth.

There are still possibilities in this method which are as yet not worked out.

The Roentgen Ray in Uterine Fibroids: Practical Deductions from One Hundred Consecutive Cases. By Mary Elizabeth Hanks, M. D., Chicago, Ill.

DR. Hanks cites facts to show the similarity between the changes attending the normal menopause and those attending the artificial x-ray menopause. Edema of the endothelial lining of the capillaries is produced; ovarian stimulation is inhibited, the ripe and ripening graafian follicles being first affected, then the primordial follicles and last the interstitial cells. If all follicles are destroyed amenorrhea will persist and the uterus will atrophy. The internal secretions of the ovary are not interfered with at all. The interstitial tissue of the ovary is the last to be affected and probably escapes with full functioning powers. It is an important source of ovarian endocrines.

The risks of failure in roentgen ray treatment of properly selected cases is so small as to be negligible.

The size of the tumors treated varies from the very small to that the size of a full term pregnancy. The indurated, non-vascular, fibrous tumor with no history of hemorrhage recedes slowly and gives least satisfactory results.

The most favorable age is forty years or older.

That certain associated pathology is a contra-indication to x-ray is not true as the author's experience proves. Prompt healing in cases of erosion of the cervix uteri has taken place under roentgen ray treatment. Follicular cysts have been much improved. X-ray reduces the typical fibroid but never reduces the large ovarian tumor. Hemorrhage has been controlled in ninety-nine per cent of the cases.

The importance of an examination exactly locating the tumor and estimating the pelvic condition in general is primary. There must be thorough systematic raying before the time when the treatment ceases. Twelve series extending over two years is the most the author has given. The average operator is too casual in his diagnosis, technique and general conduct of the case, especially in his estimation of end-results. A follow up system is essential for best results.

The author's first thirty consecutive cases show today fully eighty per cent without demonstrable tumors. The great majority of those who still have demonstrable tumors are "symptomatically cured", i. e., the patient is not conscious of its presence, it is freely movable and the menopause is established. Of the remaining cases two very large tumors have been much reduced in size and symptoms very largely remedied. One case had to be

operated because of gonorrheal infection. One case had a myxomatous and is interesting because conception took place after x-ray treatment. One case has died of heart disease, two discontinued treatment too soon, two cannot be traced and three are still problematical. No case has developed malignancy. The fear of sarcomatous transformation is not based on logical reasoning and authority is cited to support this view.

The technique employed is the cross fire method, using the Coolidge tube, nine inch spark gap, seven inch skin distance, five milliamperes and four to seven minute exposure. One large single dose is not favored by the author.

Deviations at the lumbo-sacro and the sacro-iliac joints were present in many of the cases treated and the author is inclined to consider that this may be an etiological factor and is convinced that recovery is slower and some symptoms more severe because of this interference.

X-ray has been preferred to radium because it works more slowly, reduces the larger tumors more successfully, and can be applied without loss of time, inconvenience or discomfort—also the danger is negative from roentgen rays. Intra-uterine application of radium may produce serious results.

Thousands of women are still undergoing operation without being offered the information to which they are entitled about the roentgen ray.

Foreign Body in Eye and Orbit Located by Fluoroscope. By E. Bradford Burwell, M. D., Aberdeen, Wash. Northwest Med. JCN, 1921, p. 344.

IN locating a foreign body in the eye the important point to determine is whether the body is in the globe or has passed through into the orbit.

The case reported had been injured while hammering on steel. The wound of entrance was in the upper lid, about five mm. long, through the ciliary region, upper temporal quadrant, left eye. Outer half of fundus was obscured by blood and there was much pain upon movement of the eye.

The x-ray showed a large piece of steel far back and a little to the temporal side. All efforts to remove it failed, even with the point of a giant magnet. A second x-ray showed it still in the same location as before.

To determine whether the foreign body was in the globe or the orbit the fluoroscope was employed. On account of the density of tissue the anterior view showed nothing. A lateral view showed the steel very distinctly and upon movement of the eye up and down the steel was seen to make wide excursions in the opposite direction proving that the body was partly in the globe and partly in the sclera. This diagnosis was proved at operation.

The Combined Use of X-ray and Radium in the Treatment of Malignant Disease. By James J. Clark, M. D., J. M. A. Georgia, Dec., 1921, p. 839.

THE improvement in the x-ray tube, which permits of control and the use of greater dosage, together with the use of more powerful apparatus and thick filters has so improved the technique of x-ray therapy that it is upon the same footing as radium in the treatment of malignant disease.

Both these agents may be employed together or separately.

Results obtained in the treatment of fibromatous compare very favorably with those obtained from operative measures and for malignant disease of the pelvic organs, if at all advanced, radiation therapy has as favorable a prospect as operative measures though recurrence is as apt to occur with one as the other. Operations should be as radical as possible when performed and radiation employed before and after operation.

All post-operative cancer should receive prophylactic treatment immediately after operation and at intervals for at least a year. A number of such cases have been under observation for several years without recurrence. No inoperable case should be refused a trial of x-ray or radium, for results are beneficial even in some of the most hopeless cases.

By the use of hard tubes and longer exposures effects of quite marked degree can be produced as deep as ten cm. (four inches). The same results may be secured from the use of radio-active bodies, if the quantities are large and the time of exposure prolonged but this may be dangerous while with the x-rays a measure of safety can be obtained by working at a greater distance from the skin.

The quality of the ray can be kept at a fairly constant value and the quantity to administer is the question. With a growth at a depth of two centimeters three hundred to five hundred X may be necessary to cause a retrograde change in the cancer cells. The maximum depth in any part of the body may be taken to be ten cm.

With heavy doses of penetrating rays the following points must be observed: employment of heavy filters, proper skin distances, many portals of entry, and sufficiently long intervals between exposures.

The histologic action of radium and x-ray on the cells is as follows: an edema of the endothelial lining of the blood vessels to the extent of occluding the small arteries, thus shutting off nutrition. Further treatment produces an endarteritis obliterans in the small capillaries. The effect on the cells is first a cloudiness of the nuclei, then disappearance of the entire cells and replacement by connective tissue growth.

In deep seated growths multiple areas must be treated so that the growth receives heavy dosage while the skin receives only one skin unit.

The question is raised whether all cases treated by x-ray should not later be operated in order to remove any possible buried focus and it is stated as an indisputable fact that pre- and post-operative radiation in any form of cancer is the correct procedure.

In the present state of knowledge of therapeutic radiation preference must be given to early operative treatment followed by the x-ray.

After a thorough course of treatment the patient should come back for inspection, and for treatment if necessary, for two or three years. Other methods of treatment should not be neglected. Pfahler advises the use of thyroid extract as assisting in tissue metabolism.

The end result in treating malignancy depends upon approaching it with proper knowledge of the amount of radiation required and proper administration of this dosage.

Radium Treatment of Carcinoma of the Bladder. By Benjamin S. Barringer, M. D., N. Y. *Annals of Surgery*, Dec., 1921, p. 751.

THE treatment of carcinoma of the bladder at the Memorial Hospital of New York has been divided into two periods, the one previous to June, 1919 when radium was applied through the urethra without opening up the bladder, and the other, since that time, when intra-urethral treatment plus the application of radium after opening the bladder suprapubically is used. The latter form of treatment was resorted to to destroy extensive bladder carcinoma which the first method of treatment did not reach. The cases treated covered a period of nearly five and one-half years. There were one hundred and forty-two cases of advanced carcinoma, four cases of small carcinoma, nine cases of extensive papilloma and two borderline cases. Most patients with carcinoma of the bladder have had symptoms for a year or longer but

they have not considered them as serious. Loss of weight and strength is not so frequent a symptom in this type of carcinoma as in others and appears late in the history of the case. Pain down the leg is a very rare symptom in these cases. Out of one hundred and thirty-eight cases haematuria was the first symptom in seventy and the second symptom in sixty, and did not appear in eight. Disturbance of urination was the first symptom in fifty-eight cases out of one hundred and sixteen and the second symptom in fifty-two of the others.

The author believes that many bladder tumors run true to their original histological structure but malignant degeneration may occur in a papilloma. Extensive tumors of the red papillary type should be regarded with suspicion. The more a tumor tends to a flat type the more malignant it is.

The cystostomy is made after the empty bladder has been blown up with air until the point of discomfort is reached. The operative findings in most cases have corresponded accurately with the radiographic findings. The cystogram will not however show the pedicle of a pedunculated tumor.

If the tumor is confined to the bladder it may be suitable for radiation. Infiltrated, indurated, extensive, and highly malignant carcinomata have been removed though not successfully in all cases.

Radium fairly consistently controls haematuria even though the tumor may have gone beyond the bladder.

The author believes the use of radium in hopeless cases is not advisable because it is often followed by failure than success as a palliative measure.

Papillary carcinoma can be destroyed by surface radiation by using large screened doses. Indurated carcinoma are best destroyed by implanting small bare tubes of radium into the base of the tumor throughout the indurated area and leaving them there. It is possible to find some carcinomatous area in using these, therefore, screened radium in the surface is employed in conjunction with the tube in the depth.

Intra-vesical treatment is used for growths confined to and around the bladder neck, for papillomata, pedunculated papillary carcinoma if the pedicle can be reached, and for infiltrating sessile growths of not more than two centimeters in diameter.

Suprapubic methods are used for growths other than those mentioned above if they are without metastasis. Extensive infiltration of the bladder wall, large and multiple tumors are the indication for section, to which all doubtful cases are submitted.

Gas and oxygen anesthesia are used in the suprapubic method. A long incision is made and indurated parts of the tumor are implanted with radium bare tubes placed within a quarter of a centimeter of the edge of the tumor. Surface radiation is accomplished by means of tubes of screened radium.

Carcinoma of the bladder has been removed in eleven cases by the intra-vesical method. The longest case has gone four years and four months without recurrence.

To January, 1921 twenty-nine cases of carcinoma have been operated by the suprapubic method. There were no direct deaths though one died seven weeks after operation and one other two months after. Some showed such extensive carcinoma that no radium treatment was even attempted. In ten of these the longest case having gone twenty months post-operation with a bladder clean of tumor. Five have not been cytoscoped since operation. The remaining fourteen are dead or doing badly. There has been but one implantation of tumor in the operative wound and this case had been previously operated elsewhere.

Radiotherapy of Malignant Tumors. Charles Goosmann, M. D.

THE experience of the recent years gives the radiologist good reason for the hope that is in him.

Cancer of the skin is usually of the basal cell or rodent ulcer type and permanent cure may be expected in ninety per cent of cases, although some cases of long standing, and those which have had improper treatment, are as a rule hopeless.

Epithelial tumors containing so-called pearls are less common than the above form. These are often called prickle cell cancers. They may occur on the lips, tongue, esophagus or the vaginal mucous membrane. Radiotherapy in cancer of the lip and of the vaginal walls gives good results but in the other types the results are frequently disappointing. These types are apt to spread to the lymph nodes and in such cases must be dissected out and x-ray treatment given the area of drainage as radium is less useful owing to the large area.

Glandular structures are involved in malignant adenoma, adenocarcinoma, medullary and scirrhus cancers. In these radiotherapy is indicated in inoperable mammary and rectal cases and in recurrence. Treatment of operable cases by the x-ray may be justifiable in the near future but is not at the present. In prostatic cancer radium is preferable to any other mode of treatment but tumors of the bladder present a discouraging problem.

In operable cancer of the uterus radium holds out a degree of hope, in fact the percentage of cures is relatively large. The question is whether in early and operable cases radiotherapy or operation is better. The author believes radiotherapy is the more desirable and backs this with competent opinions from abroad as well as here.

Of the sarcoma the round celled is most responsive to x-ray and radium while osteosarcoma and chondrosarcoma are the ones least influential.

The end results in mediastinal sarcoma have not been good but improved technique will bring happier results.

Good results have been secured in the treatment of cellular carcinoma of the testicle and the ovaries and in mixed tumors of the parotid. Tumors of the antrum and hypophysis are benefited and sometimes cured with combined x-ray and radium. Acromegaly has also shown improvement.

The New X-Ray Therapy. By Charles Goosmann, M. D.

MANY questions have been asked about the German methods of deep x-ray treatment, hence this paper.

Deep x-ray therapy was ridiculed upon its first appearance. With perhaps as little logic results claimed by the German workers are now being ridiculed.

Expressed in terms of peak voltages there is not so much difference between the German and the American technique. It is probable that penetration continues to increase with voltages higher even than 200,000. There are some German installations which give 250,000 volts and some American machines with a maximum of 280,000. The higher voltages are desirable if only to reduce the duration of treatments but besides this these voltages will increase the percentages of rays that reach a deep seated lesion and so lessen the damage to the skin. Kronig and Friedrich are quoted to prove that filtered gamma rays of radium and mesothorium, the only ones used in deep therapy, have a penetrating power not remotely approximated by x-rays.

X-rays are produced in a small area called the target and spread in all directions. A long target distance would give a better deep effect but is not practicable because of the length of treatment then requisite.

The area through which the x-rays are directed through the skin toward the deep seated lesion is called the portal of entry. A large portal of entry gives an increased depth dose due to the secondary rays produced in the tissues illustrated by the phenomenon of visible light scattered in passing through milk.

X-ray tubes produce a mixture of hard and soft tubes, the latter if absorbed in the skin cause severe reactions and so filtration was resorted to to bar them out. However, to secure truly homogeneous rays requires such filtration as increases the length of treatment out of all proportion to the practical benefit procured and therefore the approximate homogeneity is all that may be used.

One milliamper of current requires five times as long for a given dose as five milliamperes.

Duration of treatment depends upon voltage, target distance, milliamperage and filtration used. If the patient receives all treatment within a period of one day extreme illness may be the result; if too long an interval intervenes the total dose is rendered ineffective. Treatments concentrated within a period of four days seem to be the best. A proper combination of these five factors constitutes a treatment method.

The Albers-Schönberg method used a 38 cm. target with portal of entry of 13 to 20 cm diameter and leather filter. Gauss and Lembcke reduced the target to skin distance to 20 cm with 3 mm. aluminum filter. They used sometimes as many as thirty-six areas on the abdomen alone. The next improvement was made possible by an American invention, the Coolidge tube, which gives hard rays of constant quality and practically unlimited amount. Heavier filters and longer target skin distances were made possible by the Coolidge tube and the Sealdard ionization measurement of x-ray dosage permitted more accurate experiments. Krong and Friedrich are given particular credit for the newer technique of using a copper filter, long target distance and large portal of entry.

The German technique is not as yet crystallized. The target to skin distance varies from 23 to 70 cm. For filtration one-half to one and one-half mm. of copper is the favorite, though some use is made of one-half mm. zinc and 10 mm. of aluminum. The size of the treatment area varies also, small areas being less used. The author believes the technique of the near future will include long target distance, copper filtration and large portal of entry.

"Roentgen-Wertheim" is the name applied to the new method of treatment of uterine cancer. The bad effects, so marked as to call for a blood transfusion at times, can be mitigated, the author thinks, by spreading the treatment over a period of three or four days though this method is not approved by some of the German writers.

The claims for the new x-ray treatment (which is frequently combined with radium) can best be expressed by saying that there is a tendency to consider cancer of the breast and uterus, and sarcoma in any part of the body, as giving a higher percentage of cures from this treatment than from surgical treatment. Some American surgeons have practically abandoned operation in favor of radium in treating cancer of the uterus.

X-ray Therapy in Tuberculosis of the Testicles and Epididymis. Leopold Freund, Wiener Klin. W. 42, 1921.

THE good results obtained in the treatment of tuberculosis of bones and joints with x-rays, lead the author to study the influence of the treatment on tuberculosis of the testicles and epididymis.

Fifteen cases were under observation for about seven years. Unfortunately the author's cases were quite advanced. All had discharging sinuses, and the lesions had extended to

the vas, seminal vesicles, and the bladder. Some had tuberculosis of the kidney, and it was difficult to tell whether the disease was ascending or descending. Others had tuberculous lesions elsewhere.

In three cases in which the disease was limited to the testicle and epididymis the author met with marked success. In cases where the lesion had extended further the author succeeded in arresting the disease, closing sinuses, and preventing extension of the disease to the other testicle.

As the desired objective was to bring about a fibrosis of the diseased tissue, small and frequently repeated doses were used, viz., one and one-half milliamperes, five to six BW (spark gap) hardness, twenty cm. skin target distance, and six minutes duration. This dose was repeated daily for fourteen days, and the course repeated again in four to six weeks.

The author combined the x-ray treatment with general therapeutic measures, and even with surgical measures in particularly suitable cases. A. M. P.

The Use of Collargol and Pylon in Pyelography. E. Pflaumer, Zentralbl. f. Chir. Nr. 44, 1921.

THE author observed a number of cases in which the use of colloidal solutions (collargol, pylon) in pyelography resulted in very alarming manifestations. In two cases where the kidney was extirpated in less than twelve hours after the injection of the fluid, a microscopic examination showed that the collargol had penetrated the urinary tubules and the glomeruli causing severe necrotic changes.

According to the author the damaging effects of the colloidal solutions are due mainly to their tendency to diffuse all through the kidney substance, and this tendency is brought about by the following conditions:

1. The physical properties of the colloidal solutions.—On account of their very slight surface tension they easily enter very fine minute openings, the coagulability and the greater confluency of the colloids enhance this tendency.
2. The position and structure of the kidney.—By various muscular movements the kidney is alternately compressed and relaxed, producing a negative pressure, thus sucking the fluid into the finer tubules, and as the kidney undergoing pyelographic examination is usually damaged by long standing disease, the valvular arrangement of the tubules cannot prevail against this sucking movement.
3. Other influences such as body warmth, fine shaking movements produced by intra-renal pulsation of blood vessels, and the presence of the roentgen light rays, all tend to bring about a more thorough diffusion of the colloid in the kidney's substance.

The author concludes that none of the colloidal solutions should be used for pyelography. He advocates the use of potassium iodide solution, which if freshly prepared before use will not cause any pain, as the pain is usually due to liberation of free iodine in the older solution. A. M. P.

Roentgen Therapy in Pruritus Vulvae. Otto Schlein, Zentralbl. f. Gynaekol. Nr. 44, 1921.

THE author discusses at great length the often unappreciated gravity of the disease, which on account of the necessity of frequent scratching, keeps the patient in loneliness, and often leads to suicidal tendencies or to insanity. He then emphasizes the necessity to study every case and determine whether the pruritus is secondary to some underlying disease such as diabetes, nephritis, caused by irritative secretions in peno-urinary abnormalities, or is primary, idiopathic in nature.

The author then reviews the various therapeutic measures employed in the treatment of

this disease. He enumerates a rather long list of general and local sedatives and antipruritics. He discusses the use of injection into the sacral canal of Schleich's solution, ultra violet rays, and alpine sun lamp, as well as surgical interference in sectioning the perineal nerve. Most of these treatments were effective only in a few light cases, chiefly affording temporary relief.

He then cites a series of eleven cases treated with x-rays observed in the Bardeleben Polyclinic. All cases were, as far as could be determined by a thorough study, idiopathic in nature, about the climacteric, and very resistant to every other treatment. Complete cures were obtained in all cases.

The technique was rather simple. A hard tube of ten to 12 Wehnelt, three mm. aluminum filter, twice a week of one-half erythema dose each time, until ten to fifteen treatments were administered. Only two cases of the eleven required a repetition of the course, and one case required three courses before a complete cure was established. Some cases received local applications of astringent douches along with the x-ray treatment. A. M. P.

Serial Roentgenograms in the Determination of Healing Processes of Lesions in Pulmonary Tuberculosis. G. Liebermeister, Deut. Med. Wochenschr. Nr. 38, 1921.

THE author points out that in determining the progress of a lesion in pulmonary tuberculosis, only those plates may be used for comparison which had been obtained under an identical technique. Slight variations in technique bring about great changes in shadows so that previously faint shadows may appear strongly fibrotic, while previously dense shadows may appear very faint.

The author found that very slight changes in hardness of the tube, in length of exposure, in quality of the rays, and in the sensitiveness of the plate, were often sources of error.

To eliminate these errors the author uses a test stripe, a piece of material made from particles of metal, bone, and leather. This test stripe accompanies every one of the serial plates and is placed in the same relation to the tube in all of them. Only those plates are used for comparison in which the shadows of the test stripe appear to be alike in density.

The author also calls attention to the fact that the changes in the density of the shadows will occur in recent hemorrhages, and in loss or gain of flesh, factors which must be considered in the interpretation of these plates. A. M. P.

Changes in the Appearance of the Contrast Shadow of the Urinary Bladder in Patent Hernial Apertures. Segalizer, Mitt. d. Gens. d. Med. u. Chir. 34 h. 1.

OBSERVATIONS on the bladder in cadavers show that a bladder filled with about one hundred cc. fluid covers both internal abdominal rings of the inguinal canals. In life due to intra-abdominal pressure, the filled bladder assumes the shape as allowed by its neighboring structures. It is therefore natural that in the enlargement of the internal abdominal rings, or in widely open crural rings, the intra-abdominal pressure will force those portions of the bladder wall overlying such apertures to enter them, that being the line of least resistance. This explains why the bladder is so frequently found in hernial openings.

The author demonstrated the presence of portions of the bladder in these apertures by filling it with one hundred cc. of a seven per cent potassium iodide solution and making cystograms in at least three different positions, viz., antero-posterior, purely lateral, and the axial position.

The antero-posterior position shows projections of portions of the bladder into the crural rings in femoral hernia. The purely

lateral and axial positions show projections of the bladder into one or both of the inguinal canals.

The author was also able to demonstrate similar conditions in cases of ventral hernia.

Based upon his studies the author advises to empty the bladder completely before operation for hernia, and in a large hernia it may be necessary for the surgeon to determine beforehand the presence or absence of bladder parts in the hernial aperture. A. M. P.

Action of X-rays on Mitosis of Carcinomatous Tissue and Upon the Blood Vessels. Albert Reichhold, Muench. Med. W. Jg. 68, 28, 1921.

EXAMINATION was carried out in five cases of carcroids of the lip before, shortly after irradiation, and a long time after irradiation. Only one hundred x was given. The carcroids disappeared by the treatment. Immediately before and after irradiation tissue sections showed numerous regular mitotic figures. About ten to fifteen to a square millimeter, with regular markings of the nucleus and granules. In the section taken four days after irradiation the chromatin bodies were broken down and scattered irregularly throughout the cell. The mitotic figures were entirely irregular. The nuclei would not stain, and cells appeared decomposed. A rich vascularization was also observed so that it gave the appearance of a cavernous structure. The endothelial cells were compressed and cubical in form.

A. M. P.

Roentgenological Differentiation Between Cardiac Hypertrophy and Cardiac Dilation. H. Dietlen, Zentralbl. f. Gef. u. Herz Kramk. Nr. 44, 1921.

AFTER a lengthy discussion of the physiopathology in either of the two conditions and their clinical manifestations the author pointed out the following observations from which a roentgenological differentiation can be made:

The hypertrophied heart shows a marked arching of its borders, especially that of the left ventricle, and the apex. If the right heart is also hypertrophied, its border also shows marked arching. The whole heart may thus be designated as the round heart. Such a heart is spherical in shape. The arches formed by the ventricles and auricles are definitely delimited from the arch formed by the great vessels.

The heart contractions are of larger excursions and time of systole is short.

The hypertrophied heart is rather constant in form, does not change much with position, nor is it influenced by changes in the intrathoracic pressure.

The dilated heart has a less definite form than the normal. Sometimes only one particular portion is dilated. In a generally dilated heart it appears wide, stretched, and lies on the diaphragm, the right cardio-phrenic angle being enlarged. There is a diminished constancy in form, so that the form of the

heart varies with changes in the intrathoracic pressure, also with changes in position and weight. It becomes smaller on inspiration and larger on expiration. The contractions are of small amplitude, and the time of diastole is short. A. M. P.

The Heart in Healthy and Sick Infants as Determined by Roentgenoscopy. Lange and Feldman, Deut. Med. W. 47, 960, 1921.

THE authors observed heart shadows by roentgenoscopy in one hundred and fifty healthy and sick infants. Healthy infants showed a relatively large heart. Infants with exudative diathesis showed enlargement above the normal in fifty-five per cent of the cases, while in cases of acute or chronic digestive disturbances, as well as in other cases of malnutrition the heart was smaller than normal.

The authors used the technique described by Altstaedt. The infant being placed under the fluoroscopic screen the transverse diameter of the chest in its greatest expansion is obtained, likewise the transverse diameter of the heart in diastole. The quotient of the transverse diameter of the heart over the transverse diameter of the chest (Tr. diam. heart—Tr. diam. chest) should normally equal one to one and nine-tenths or one to two. A quotient of one to one and seven-tenths was considered an abnormally enlarged heart and one to two and five-tenths an abnormally small heart.

A. M. P.



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X-Ray Spectra Produced Under Various Experimental Conditions*

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I.

RECENT researches in radiotherapy indicate that much can be gained by the employment of penetrating x-rays in the treatment of certain diseases in which the diseased tissues lie some distance below the skin. As a general rule, x-rays of short wave length penetrate through matter farther than x-rays of long wave length do. This does not appear to be the case always. In the following pages I shall give examples in which matter of high atomic weight absorbs short x-rays to a much greater extent than it does long x-rays. In tissues, however, the x-rays ordinarily used carry with them and deposit at a distance below the surface more radiant energy as compared with the amount absorbed by the skin, if they have short wave lengths, than they do if they have long wave lengths. This fact may be ascribed to several causes. Firstly, the primary beam of rays that travel in straight lines from the target of the tube to the diseased tissues below the skin penetrates the intervening tissues more easily, if it contains x-rays of short wave length. Secondly, the secondary, tertiary, etc. radiation that comes from the surrounding tissues, and that constitutes a large part of the total radiation reaching the diseased tissues, bears a greater ratio to the primary beam, if the primary beam consists of short wave length x-rays, than it does if that beam consists of long wave length x-rays. A third reason for employing x-rays of short wave length may be found in the fact that the fraction of the energy of the cathode rays transformed by the x-ray tube into energy of x-radiation increases markedly as the wave length of the rays decreases. Lastly, a much larger portion of the x-radiation passes through the filters, consisting of chemical elements, such as copper, that are employed to cut off the easily absorbed x-rays, if the primary beam contains x-rays of very short wave length.

Since the character of an x-ray beam and the effects it produces at different

points in its path depend upon the wave lengths of the rays it contains, it becomes a problem of prime importance to study the spectra of x-rays produced under various conditions. For deep radiotherapy, in particular, we must determine the best methods of generating very short x-rays, and of filtering out the long ones. This paper contains an account of some experiments on the spectra of x-rays that have passed through certain filters. The first examples illustrate normal absorption of the x-rays, that is, that in which the absorption increases with the wave length. Then follows a case of abnormal absorption, where x-rays of short wave length are cut off by the filter to a much greater extent than are x-rays of longer wave length. Finally, experiments are described on the spectra of x-rays produced by different methods of exciting the x-ray tube. In particular, the spectra produced by a constant, non-fluctuating voltage and by an alternating voltage have been compared with each other.

II.

Before passing on to the experiments themselves, I shall describe the apparatus and the method of investigating the spectra. Fig. 1 represents the arrangement of the apparatus. The x-rays

come from the target, T, of the x-ray tube, and some of them pass through the hole in the brick wall into another room. The second room contains the x-ray spectrometer. Placing the x-ray tube in one room and the spectrometer in another, affords excellent protection for the spectrometer against stray radiation. Protection of this kind becomes exceedingly important, if high voltages are used in producing the x-rays. Additional protection has been obtained by fastening a lead plate one centimeter thick against the wall on the side toward the tube.

The target lies in such a position that the rays that go through the hole leave the target in directions almost parallel to the surface of the target. This is of great importance when a detailed analysis of the spectrum is desired, for under these conditions the source of the rays as seen from the hole approximates to a narrow line. The arrangement, however, possesses certain disadvantages, since the cathode rays produce some of the x-rays at the bottoms of the little indentations that appear on the surface of the target after the x-ray tube has been thoroughly seasoned. The sides of these little hollows and the small protuberances on the target's surface absorb a very perceptible amount of the x-rays. The experiment described

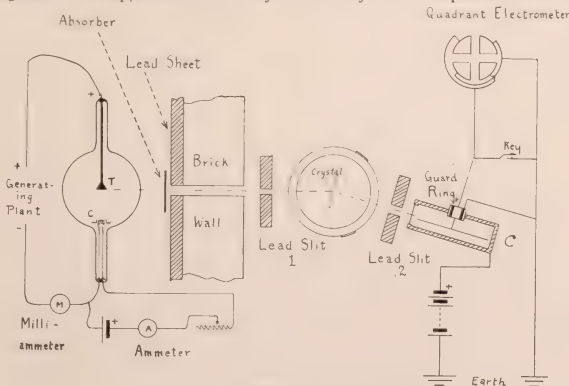


Fig. 1.

*—Read at the annual meeting of The Radiological Society of North America Chicago, December, 1921.

in section three furnishes a good example of this absorption by the target of its own radiation.

After emerging from the hole in the wall the x-rays pass through a thin crystal. In the interior of the crystal (if it lies in the proper position) some of the x-rays are reflected, and deviate from their straight line courses in accordance with the fundamental discoveries of Laue, Friedrich and Knipping. These reflected x-rays pass in turn into the ionization chamber, which, of course, must have been placed in the proper position to receive them. The quadrant electrometer measures the electrical current flowing across the ionization chamber.

For an accurate analysis of spectra slit one should be made narrow, thus defining a narrow beam of x-rays. Slit two should be wide enough to admit the entire reflected beam into the ionization chamber. Secondary x-rays pass off in all directions from the points in the crystal struck by the primary x-rays, but the reflected rays are much stronger than the secondary rays, and come from the crystal in one direction only. This direction makes the same angle with the planes in the crystal on which its atoms lie as does the beam of rays coming through slit one. In other words, the angle of reflection equals the angle of incidence. In accordance with the laws stated by W. H. and W. L. Bragg (who first designed x-ray spectrometers) only x-rays of given wave

lengths are reflected at given angles. The relation between the wave length λ of an x-ray and the angle θ at which it is reflected may be expressed by the equation, $\lambda = 2d \times \sin \theta$, where d is the distance between neighboring planes of atoms in the crystal. In the experiments described in this paper calcite was used as a reflecting crystal, and $2d$ has the value, $2d = 6.056 \times 10^{-8}$ cm. The crystal also reflects x-rays of wave lengths $1/2\lambda$, $1/3\lambda$, etc., but very much less strongly than it does x-rays of wave length λ .

III.

By setting the crystal at different angles (and the ionization chamber at corresponding angles), and by measuring the ionization current for each angle, data may be obtained from which curves may be drawn that represent the x-ray spectra. Fig. 2 contains such a curve. In this experiment a constant voltage of 161,000 volts drove a current of one milliamper through a Coolidge x-ray tube with a tungsten target. The absorber (or filter) consisted of a sheet of copper .48 mm. thick. As the rays all pass through the crystal, however, before they reach the ionization chamber, the absorption by the crystal must be added to the filtration. The crystal used was equivalent to about 1.5 mm. of aluminum.

Several sharp peaks appear on the curve. These represent exceptionally intense radiation at the wave lengths corresponding to the angles marked be-

neath them. Taken together they form the K series of lines in the emission spectrum of the tungsten target. The lines are usually designated by Greek letters. They have the wave lengths $\lambda_K = .2134$, $\lambda_L = .2086$ and $\beta = .1842$, when expressed as fractions of an angstrom, the unit of length usually used in measuring wave lengths. One angstrom equals the one-tenth millionth part of a millimeter. Other lines belong to the spectrum of tungsten, but the above three are the only important ones in radiotherapy. The wave lengths of x-ray spectrum lines in general depend only upon the chemical element, or elements, used as a target in the x-ray tube. They do not depend upon the voltage applied to the tube, nor on the current through it, nor on any other experimental condition. Every chemical element has its own set of lines. Their wave lengths may be found tabulated in a report written by the author and published by the National Research Council.

In addition to the peaks the curve indicates the presence of a continuous spectrum containing x-rays of all wave lengths down to the wave length $\lambda = .0766$. At the point marked A a sharp drop occurs. This drop represents the absorption by the tungsten target itself, as explained in section two. The drop appears at a wave length, $\lambda = .1781$, just a little shorter than the shortest of the emission lines. The absorption is of a peculiar kind.

X-Ray Spectra

Constant Voltage 161,000 volts, Current 1.00 ma
Filter 48 mm. of Copper

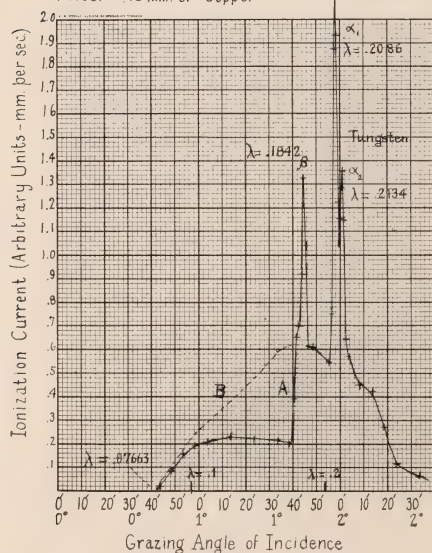


FIG. II.

X-Ray Spectra

Constant Voltage 164,000 volts, Current 100 ma
Filter Curve A ---- 3.44 mm Cu Curve B ---- LaCl₃

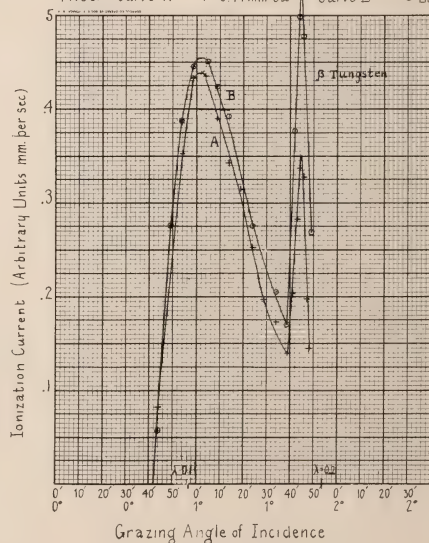


FIG. III.

The tungsten absorbs x-rays of all wave lengths, but it absorbs x-rays of wave lengths shorter than the value .1781 to a much greater extent than it does x-rays longer than .1781. For this reason tungsten would not be a good substance to use as a filter, if a beam of short x-rays were desired. Had the surface of the target been very smooth, and had it been turned so that the x-rays reaching the spectrometer came from the focal spot in directions making large angles with the target's surface, this great characteristic absorption by the tungsten would not have occurred. The curve would have lain in some such position as that represented by the dotted line, B. The position of the line B has been calculated on the assumption that the co-efficient of absorption varies as the cube of the wave length, which probably represents only an approximation to the truth.

At its lower end the continuous spectrum has a very sharply defined minimum wave length. The value of this wave length depends upon the maximum voltage applied to the x-ray tube, and on nothing else. ⁽²⁾ The relation between the minimum wave length, λ , and the maximum applied voltage, V , may be expressed by the equation, $V\lambda = 12.354^{(3)}$. Equation two may be used to calculate the minimum wave length, λ , produced by a given maximum applied voltage, V , or to calculate the maximum voltage, if the minimum wave length has been measured. A small correction has to be made in estimating the minimum wave length from the shape of the curve. Spectrum curves always appear to indicate voltages slightly in excess of their real values. The correction arises from the fact that the focal spot on the target and slit one in the spectrometer are not mathematical lines. The magnitude of the correction may be obtained from the breadth of a single peak on the curves that represents a single emission line, or, better, from the breadth of the sharp drop in the curve that represents a characteristic absorption. Half of this breadth must be added to the angle corresponding to the point at which the curve reaches the zero axis. The correction ought not to be large. In good experiments it ranges from a fraction of one per cent to several per cent, depending upon the accuracy of the apparatus, etc.

Spectrum ionization curves do not represent the relative intensities of the radiation at different wave lengths. They correspond rather to the relative amounts of energy absorbed in a given quantity of gas in a given time. The same statement applies to photographs. The chemical action in the photographic film comes from the energy absorbed in it. In radiotherapy we are interested

more in the amounts of energy absorbed than in the amounts that pass through the tissues.

The ionization curves, however, do represent both the relative amounts of energy absorbed and the relative intensities of the radiation of the same wave length under different experimental conditions. This point is brought out in the particular examples discussed in the following sections.

IV.

The introduction of absorbers, or filters, in the path of the x-rays coming from the target changes the shape of the ionization curve ⁽¹⁾. In other words, it alters the distribution of energy in the spectrum.

The writer, in collaboration with research students, has begun a thorough investigation of various filters with a view to determining their efficiency in producing x-rays with relatively large amounts of energy in the short wave length parts of their spectra. The experiments described in this and the following section serve only as illustrations of this extended research.

The two curves in Fig. 3 represent the spectra of x-rays that have passed through filters of metallic copper and of lanthanum chloride respectively. The constant voltage applied to the tube amounted to about 164,000 volts.

The thickness of the copper filter was 3.44 mm. On comparing the curve corresponding to this filter (Curve A, Fig. 3) with the curve of Fig. 2, for which the thickness of copper amounted to only .48, we find a marked difference in the distribution of energy. The 3.44 mm. curve has a pronounced maximum in the neighborhood of wave length, $\lambda = .11$. This maximum is higher than the peak representing the β emission line of the tungsten spectrum at wave length $\lambda = .1842$. On the other hand, the β peak on the curve of Fig. 2, for .48 mm. of copper filtration, is very much higher than the curve at $\lambda = .11$. An accurate quantitative comparison between the curves of Fig. 3 and that of Fig. 2, cannot be made, as the experiments were performed under slightly different conditions. A special experiment, however, has shown that the increase of about three mm. in the copper filtration reduces the intensity at wave length $\lambda = .1$ to about forty per cent of its original value, whereas at wave length $\lambda = .2$, the same increase of filtration reduces the intensity to about five per cent of its original value. This illustrates well the transparency of metallic filters for short x-rays mentioned in section one.

The experiments represented by the two curves of Fig. 3 were performed under identical conditions except the filtration. The curves, therefore, give accurately the relative intensities of the

x-rays at any particular wave length. Comparing them, we find that at wave length $\lambda = .11$ the lanthanum chloride salt was just thick enough to let through three and four-tenths per cent more radiation than the 3.44 mm. of copper did. At the β peak, however, ($\lambda = .184$) the lanthanum chloride let through a much larger fraction of the radiation than the copper did. Hence, a salt composed of a metal of medium atomic weight (such as lanthanum) and a chemical element of low atomic weight (such as chlorine) does not appear to be as good a filter to use for producing short x-rays as a pure metal of fairly low atomic weight, such as copper.

V.

The experiments described in section four illustrate normal absorption, that is, that in which the filter absorbs x-rays of long wave length more strongly than it does x-rays of short wave length. We now come to a case of abnormal absorption, in which the filter produces an exceptionally large reduction in the intensity of the short wave length part of the spectrum.

The curve of figure four represents an experiment with a filter consisting of a sheet of lead .48 mm. thick. The α and β peaks of the tungsten emission spectrum appear on the curve. The curve differs, however, from those of Fig. 3, in that a sharp drop occurs at wave length $\lambda = .1411$, indicating a marked increase in the absorption by the lead of x-rays shorter than .1411, as compared with its absorption of x-rays a little longer than .1411. Had the lead absorbed the x-rays as the copper did, the curve would have followed some such course as that represented by the dotted line, B, in Fig. 4.

Figures 3 and 4 represent experiments performed under the same conditions except for the filtration. Hence, we may compare with each other the intensities at any particular wave length. On examining the radiation in the neighborhood of wave length $\lambda = .184$ we find that the 3.44 mm. of copper absorbs much more of the x-ray energy than the .48 mm. of lead does. On the other hand, in the neighborhood of wave length $\lambda = .1$ the lead absorbs much more than the copper does. We cannot speak, therefore, of the equivalence of different thicknesses of different substances for absorbing x-rays in general. We can compare the thickness of one substance with that of another which produces the same absorption only at particular wave lengths, or in particular regions of the spectrum.

All chemical elements have characteristic wave lengths at which this normal absorption occurs. At Harvard we have obtained data and drawn ionization curves that determine the posi-

X-Ray Spectra

Constant Voltage - 164,000 volts.
Current 1 milliampere Filter 0.46 mm Lead
Characteristic Absorption of Lead at A

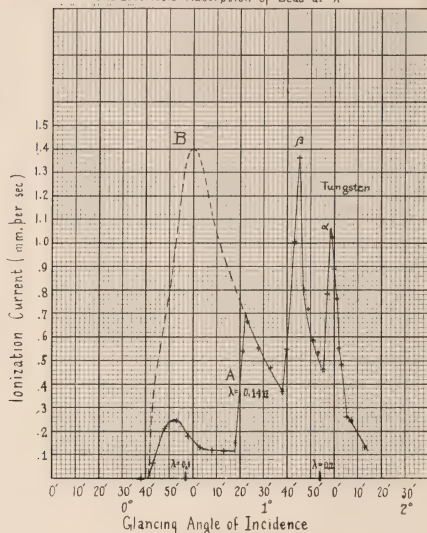


Fig. IV.

tions in the spectrum of these characteristic wave lengths for almost all of the chemical elements. The data may be found in the report mentioned above in section three.

If we desire to produce a beam of short x-rays, we must not use a filter that contains chemical elements, whose characteristic abnormal absorption wave lengths lie in the region of the x-ray spectrum employed. An examination of the tables in the above mentioned report shows that chemical elements of higher atomic weight than that of lanthanum have abnormal absorption wave lengths shorter than $\lambda = .34$. This is the region of the spectrum usually employed in x-ray therapy. Hence, filters containing chemical elements of much higher atomic weight than that of lanthanum should not be used. Tungsten, mercury, lead, etc., have higher atomic weights than lanthanum, and should not be used as filters. For purposes of protection against short, penetrating x-rays, however, such chemical elements are very effective.

VI.

I now wish to take up the question whether the mode of exciting the tube has any effect upon the spectrum of the x-rays. Curve A in Fig. 5 represents the spectrum produced by a constant, non-fluctuating voltage of 164,000 volts. A plant consisting of transformers, condensers, electrical valves, etc., generated the non-fluctuating voltage. In the experiment represented

X-Ray Spectra

Constant Voltage ---- +, Fluctuating Voltage ---- o
Maximum Voltage 164,000 volts; Current 1.00 ma.; Filter 3.44 mm. Cu

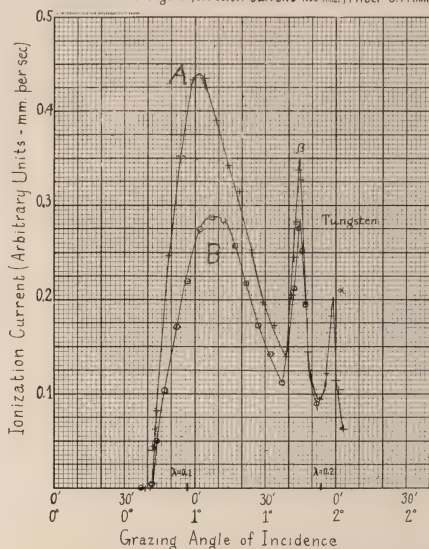


Fig. V.

by curve B an alternating voltage having a maximum value of 164,000 volts produced the x-rays. The same current (1.00 milliampere) passed through the tube in each case, and the same thickness of copper (3.44 mm.) filtered the rays. A comparison of the two curves shows that the constant voltage produced more intense x-radiation than the alternating voltage did. Further, there appears to be a shift of radiated energy toward the short wave length end of the spectrum in the case of the constant voltage as compared with the alternating voltage. For instance, at the β peak ($\lambda = .1842$) curve A indicates an intensity of radiation about twenty-two per cent greater than curve B does. At the maximum point on curve A ($\lambda = .11$) the constant voltage produces about sixty-six per cent more than the alternating voltage does. Finally, near the short wave length limit of the spectrum ($\lambda = .85$) the constant voltage radiation becomes more than one hundred per cent greater than the alternating voltage radiation. Thus both the intensity and the penetration of the x-rays through tissues, and through filters of medium or low atomic weight may be increased by using a constant voltage instead of an alternating one having the same maximum value as the constant voltage, other conditions remaining the same. The reason for this appears to be easy to understand. In accordance with the law expressed by equation one, the

voltage must rise above a certain value, V, in order to produce x-rays as short as any given wave length, λ , the constant voltage remains above this value, V, and produces x-rays of length λ all the time. On the other hand, the alternating voltage fluctuates above and below the value, V, and produces x-rays as short as λ only a portion of the time.

I have presented curves at scientific meetings showing that at lower voltages the same marked difference between the two modes of exciting the x-ray tube occurs. Other experimenters have found little difference between them in the case of practically unfiltered rays.

The fact that the character of the exciting voltage has so large an effect upon the spectrum of filtered x-rays, becomes of great importance in connection with the estimation of dosage. A measurement of the maximum voltage, the current through the tube and the filtration does not suffice to determine either the intensity or the penetration of the x-rays. In case of heavy filtration one may make errors amounting to several hundred per cent by such a procedure alone.

The safest plan appears to be to examine the spectrum of the x-rays produced by each type of generating plant.

- (1)—Duane and Hunt, Physical Review, August, 1915, page 166.
- (2)—Duane and Hunt, Physical Review, August, 1915, page 166.
- (3)—Duane, Palmer and Yeh, Jour. of The Optical Society of America, May, 1921, page 213.

James G. Van Zwaluwenburg---A Memorial

Rollin H. Stevens, M. D.
Detroit, Michigan

IN the early hours of Thursday, January 5th, Dr. James G. Van Zwaluwenburg, Professor of Roentgenology in the University of Michigan, lay down his work and passed from our midst, after a brief illness from pneumonia.

The hand of a master in most important work in the broad field of roentgenology has been stayed. The world of science has suffered an irreparable loss.

Dr. Van Zwaluwenburg had been working in roentgenology only some eight years and but few, outside his intimate friends, realize what he accomplished in those few years.

His work on pneumoperitoneum was a rare contribution of great value. His paper on "Pneumoperitoneum of the female Pelvis," and his scientific exhibit at the Annual Meeting, in December, will be remembered as a mile post in roentgen diagnosis. His study of pleural or apical caps as signs of the origin of many cases of tuberculosis in an apical pleurisy is also a valuable contribution. Dr. Van Zwaluwenburg also had accumulated a vast amount of data along other roentgenological lines, much of which he did not consider quite ready for publication. It is hoped his study of this material will not be wholly lost.

"Van," as he was usually called by his associates, was born in 1874 in Ottawa County, Michigan, of Dutch-American parentage. He graduated from Hope College, Holland, Michigan, and after teaching chemistry there for one year entered the University of Michigan and received from there the degree of Bachelor of Science in 1898. The next five years he devoted to chemi-

cal engineering and physics in that university, after which he entered its medical school, acting as a demonstrator of anatomy during his undergraduate years and receiving the degree of M. D. in 1907. The two years following his graduation he was an assistant to the Chair of Internal Medicine at the University of Michigan and then became an instructor in that subject. His previous training eminently fitted him for the work of roentgenology, in which he soon became interested. In 1913 he held the position of Associate Professor in that subject, and in 1917 he was made Professor of Roentgenology of the



Medical School of the University of Michigan. He was a valued member of the American Roentgen Ray Society and of The Radiological Society of North America.

He is survived by his widow, a son and a daughter, to whom we express our sympathy in their great and irreparable loss.

Dr. Hugh Cabot's tribute, as published in the "Michigan Daily," sums up so beautifully and so truthfully what manner of man Dr. Van Zwaluwenburg was that it is quoted here:

"In the death of Dr. Van, the University has lost an invaluable servant, science has lost an important exponent and the world has lost a great man. In his work he demonstrated integrity to a very high degree. Utter self forgetfulness was his, even to success, and the only thing he ever neglected was himself.

"His capacity for organization and his knowledge of business methods were of a grade rarely found in medical men. His previous training as a chemical engineer gave him a broader outlook than is commonly found in medical specialists. Of his scientific work in roentgenology it would be difficult to speak too highly, though his actual publications were few.

"He insisted for himself and others on a degree of absoluteness of demonstration which often made him unwilling to publish work which was anything short of complete. Most catholic in his thinking, he never allowed his theories to become for him facts.

"A keen reasoner, a sharp critic, a good loser and a modest winner, he has left a place in the clinical staff of the Medical School, which it will be utterly impossible to fill. He left the impress of his personality upon all of us, and though he has gone, we shall go forward more steadily and more generously than would have been possible without the inspiration of his example."

In the archives of The Radiological Society those personal attainments which bespoke the man will be held inviolate and his memory remain sacred.

Pelycography---Its Field and Its Limitations*

JAMES G. VAN ZWALUWENBURG, B. S., M. D.

Ann Arbor, Michigan,

From the Department of Roentgenology, University of Michigan

AFTER an experience of nearly one and one-half years with the method of pneumoperitoneum as applied to the examination of the female pelvis, it seems that the time has come to attempt to evaluate the method, circumscribe its field and define its limitation. This is the more necessary because of the gloomy picture drawn for us in the report on this subject which was read before the Washington meeting of the American Roentgen Ray Society last September and the conclusions of which, it seems to us, are not entirely just when one considers all the conditions as well as the few facts.

In attempting to estimate the value of any method of examination, one must assume as of the first importance the welfare of the patient. A method is valuable in just so far as it contributes information which can not be so well obtained otherwise and which contributes to the proper treatment of the case without adding disproportionately to the dangers, discomforts, or costs. In the comparison of any two methods of investigation, it is unfair to contrast simply the dangers of the two methods; it is necessary to examine as well the relative funds of new information that one may hope to gain as compared with the risks involved under comparable conditions of experience. It is unfair to compare the four reported deaths which have occurred on attempting to introduce gas into the peritoneal cavity with the mortality of the highly perfected technical methods of the exploratory laparotomy because of the element of inexperience in much of the work done by the newer method. It would be more nearly fair to compare

the early results of laparotomy with the data from a comparable period of the newer method. It is quite possible that experience with the knife and with surgical asepsis does not in itself qualify a man to wield a lumbar puncture needle in an attack on the peritoneum; in the one case a man is guided by the eye, in the other he must depend on other senses, such as touch and resistance. If it can be proven that the danger is not serious and that no serious disturbances result from the presence of gas in the peritoneal cavity, it should not be impossible to avoid injury to the abdominal organs through the development of a suitable technique.

This appears to us not hopelessly difficult when we consider the vast experience of animal workers. Our own observations of the awkwardness of the beginner make it quite comprehensible that accidents should have happened. It is, to be sure, a surgical procedure and should not be lightly undertaken by one who is not well grounded in aseptic technique, but it is probably safer in the hands of an experienced non-surgical man than in those of the skilled general operator without special experience. It may be compared with anaesthesia; far safer in the hands of a well trained nurse than in those of a senior medical student.

Moreover, who has ever seen a purely "exploratory laparotomy?" Is it not against human nature to expect a surgeon with an established reputation to undertake such an operation with the expectation of establishing the absence of pathology? He will not operate unless he expects to find something wrong which he can right and one cannot expect him to desist without making good his judgment by removing something, if only an impertinent appendix. And in the computation of risks of such a purely exploratory operation, how are we to discriminate between the mortality (not to mention the morbidity) due to the exploratory element of the procedure as distinct from the corrective surgery that accompanies it?

It seems to us, therefore, that a direct comparison between the two methods, such as was attempted, is not justified. On the other hand, the proponents of the gas inflation method are under clear obligations to demonstrate not only that it is less dangerous than exploratory operation, but that it is much less dangerous. For it is obvious

that the imperfect image produced by the x-ray can not be expected to furnish as much information as can be derived by direct inspection and handling of the diseased organs. The danger must, therefore, be at least as much less as the information is less reliable.

The demonstration of such a degree of safety is not yet possible and it will not be possible until the method has been in use longer, until its dangers are appreciated, measures have been devised to obviate them, and the statistics of many experienced men are available for study.

From the University Hospital we are now able to add considerably to the list of cases in which pneumoperitoneum has been applied as a diagnostic measure. Up to date something over three hundred and fifty cases have been inflated; some by the transuterine and some by the transperitoneal routes. So far no harmful effects of any kind have been seen. We have managed to avoid puncture of solid or hollow organs, and by the simple expedient of observing that no blood escapes from the needle on removal of the obturator, we have insured against injecting gas directly into the circulation. I am convinced that inexperienced operators have on more than one occasion introduced one thousand cc. of pure carbon dioxide into the subcutaneous panniculus, but no more than a local and very transient interstitial emphysema has resulted. We offer as an explanation of the relative harmlessness of this accident the extraordinarily rapid absorption of this gas. Of course, the only excuse for such an occurrence is inexperience.

The introduction of gas by way of the uterus is free from the objections ordinarily raised against abdominal puncture. There is, on the other hand, the theoretic danger of carrying infection along the tubes and into the peritoneal cavity and the danger of inducing abortion in unsuspected pregnancy. These dangers can only be avoided by the judicious selection of cases. The gynecologist in charge of this work is insistent on the greatest caution, and every inflation is preceded by a thorough clinical examination. If there is any suggestion of a purulent discharge from the os or the history of a skipped period, the transperitoneal route is selected. I can only say that neither of these complications have appeared in our series. The infected tube has al-

*--NOMENCLATURE

A convenient and distinctive terminology for the processes and products of this examination is badly needed. The completely descriptive term "pelvic pneumo-peritoneo-roentgenography" is recommended only by the accuracy of its description. "Pelygraphy" has been suggested but is objectionable because it is not euphonious, because it is not distinctive, being liable to confusion with the process properly called "pelography," and because it combines both Latin and Greek roots in the same word.

We suggest the use of the equivalent Greek root "pelyco," (from Πελυξ a basin, the pelvis), thus: "Pelycography" and "Pelycogram." These are etymologically correct, distinctive, simple and euphonious in all their combining forms.

**--Read at the annual meeting of The Radiological Society of North America, Chicago, December 7, 1921.

ways been effectually blocked and the unsuspected pregnancy has not materialized.

Dr. Peterson naturally prefers the transuterine route because of the added and valuable information it furnishes as to the condition of the tubes and its bearing on the causes of sterility. This is information that can not be obtained in any other way. If the attempt to inflate by this route fails or if there are contraindications, he has no hesitation about attacking the belly wall, confident that in his experienced hands and in those of his assistants the dangers are negligible.

Of the three hundred and fifty cases examined, one hundred and fifty-three have been confirmed, either by operation, or, in the case of pregnancy, by the test of time. These one hundred and fifty-three cases have been tabulated and studied with reference to the correctness of our readings and the causes of our failures. In all cases our readings have been made without the knowledge of the clinical history or the results of bimanual examination, and our conclusions have been drawn from the evidence of the stereoscopic image alone. This is an unnecessarily severe test of the possibilities of the method if one considers only its value to the gynecologist. Many, if not most, of our most serious errors would have been avoided had we had some information before hand. It seems important, nevertheless, to test the unaided possibilities of the method for recognizing anatomical changes and the interpretation of the meaning of these changes in terms of pathology. As a matter of fact, these readings have always been open to review with the gynecologist and a joint opinion reached in all cases of conflict before the patient was subjected to operation.

At first, during the experimental stage, the method was used rather promiscuously in all manner of con-

ditions and with numerous technical variations. From the technical side, it is interesting to note that in the arrangement of a suitable table the tube was for a time placed below the patient for reasons of convenience. Much to our surprise, we found the results were not equivalent to those to which we had been accustomed. It was found almost impossible to satisfactorily project the pelvic floor, and since this shadow was an important factor in the differentiation of several conditions as we had learned to know them, we were obliged to abandon the idea. We explain this difference in the images by the fact that the pelvic cavity is approximately cone shaped. The bundle of rays falling from above passes nearly in the plane of the floor of the pelvis, but the rising ray meets it at a rather broad angle. The projected images are, therefore, quite different. For these reasons we have returned to the original overhead position of the tube.

We early learned that the most important feature in the technique is the inclination of the patient to the horizontal. The uterus is seen only by virtue of the surrounding gas. In order that its entire perimeter may be projected, it is necessary that the uterus hang freely suspended from the floor of the pelvis and that the ray fall vertically in the axis of the uterus. The proper inclination is, therefore, important. Unfortunately, this position can not always be attained, since many women have not the necessary lumbar lordosis and others have lost the flexibility of the lower spine through chronic inflammatory processes. Practically every case must be studied individually to secure the optimum results.

The necessity of emptying the bladder and colon need only be mentioned to be appreciated.

It soon became apparent that it was unreasonable to expect to add anything

to the information of the gynecologist concerning those large tumors which are clearly of pelvic origin and present palpable masses in the abdomen. The pelvis is invariably so filled with the mass that proper inflation and differentiation of the structures that are not displaced by the mass and that remain in the pelvis is impossible. On the other hand, the confirmation of the opinion of the gynecologist that an obscure abdominal mass is not of pelvic origin and the identification of such masses as omental cysts, renal, and splenic tumors, is of at least academic interest and serves to demonstrate the possibility of the method. In more than one case the otherwise inevitable operation has been avoided.

Several cases of advanced pregnancy have been subjected to this examination with interesting and characteristic results. It is obvious that in the uncomplicated case there is little prospect of adding to the information which the obstetrician can command and the method can not be defended as contributing to the welfare of the patient. However, the demonstration of a dermoid cyst and a pelvic abscess in the presence of normal pregnancies is of rather more than academic interest and represents a distinct contribution to the diagnostic data. Both of these conditions have fallen under our observation, and in neither case did harm result from the inflation.

The demonstration of normal pregnancy seems to be least difficult between the sixth and the sixteenth weeks. Before the sixth week the changes are so slight that they will escape observation; after the sixteenth week the fundus has reached the abdomen and is no longer in the center of the field of vision. In the latter case the diagnosis is usually obvious in any case and the examination purposeless.

Experience with ectopic pregnancy has not been altogether happy. This is

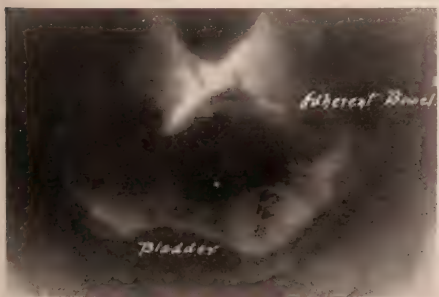


Figure I—Nearly normal pelvis. There is a minor degree of traction displacement to the left due to adhesions about the left ovary, which lies on the floor of the pelvis and whose shadow is covered by bowel shadows. Note the normal course of the broad ligament shadow.



Figure II—Bicornate uterus. The sulcus dividing the fundus also indents the isthmus.



Figure III—Nodular fibromyoma. Note the irregular outline of the fundus and the disproportionate and asymmetrical enlargement of the isthmus. Compare with Figures IV and V.

principally because the secondary changes which ensue so rapidly lead to confusion with inflammatory conditions. The demonstration of the extrauterine mass is invariably easy, but the proper interpretation of this obvious shadow is difficult. On the other hand, it has twice been our good fortune to have corrected the gynecologist's diagnosis of ectopic pregnancy by demonstrating a normal pregnancy in the normal situation, but complicated by an extrauterine condition.

In supposed pelvic tuberculosis, the method bears in several ways. For instance, the x-ray evidence, unsupported by any clinical findings, led to the removal of a pair of tuberculous tubes. By this means also tuberculosis of the pelvic peritoneum has been excluded as a cause of ascites and diffuse adhesive tuberculous peritonitis has been demonstrated as the cause of pelvic symptoms.

Apart from the demonstration of the patency of the tubes in sterility, perhaps the most valuable contribution is

found in the "negative diagnosis." You are all familiar with the neurotic young woman with a dysmenorrhoea without palpatory findings. The examination may leave the gynecologist unconvinced of the complete normality of the pelvis. There may be a suggestion of minor trouble with the adnexa, the possibility of early pelvic tuberculosis must be considered. The patient particularly dreads anything connected with that name. She demands relief and the "urge" for operation is very great.

If the surgeon does operate, he can always remove an appendix as a justification for the operation in the confident expectation that the pathologist will confirm his suspicions that it is diseased. Or he may incise a few harmless follicles or perhaps do more serious and less excusable damage locally. In any case, he usually establishes a definite "psychic trauma" and confirms the patient in her invalidism. There is the consideration that there is no difficulty in satisfying the patient that something

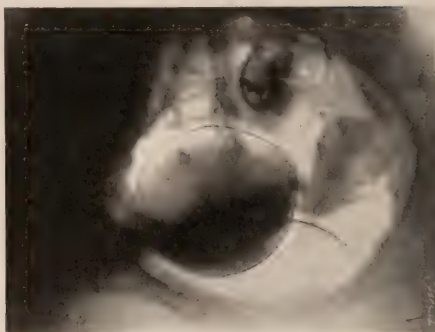


Figure IV—Pregnancy of six weeks duration. The widening of the isthmus in its transverse diameter is well shown. Displacement to the right by ovarian mass on the left whose character has not yet been determined, probably cyst (Retouched).

has been done and the surgeon is the recipient of such credit as may result.

The pelycogram is singularly sensitive to relatively slight changes in the morphology and relationships of the pelvic organs. Minor changes in the size of the ovary, thickening of the tubes, adhesions, fixations, traction distortions; all are shown in striking contrast to the picture of the normal pelvis. Many of these changes will be pronounced of no consequence by the gynecologist and pathologist. It is, therefore, a fairly safe conclusion that the pelvis which appears normal to the sophisticated x-ray eye is in fact without significant pathology. The conscientious surgeon will be glad to leave such patients alone as soon as he is convinced of the reliability of the x-ray method and of the man behind the method.

I regret that the time allotted to me does not permit me to discuss in detail the tabulated results on the one hundred and fifty-three cases, as I had at first



Figure V—Pregnancy, fourteen weeks. Fundus in the lower abdomen represented by a diffuse and inconspicuous shadow with smooth, rounded margin. Conspicuous shadow of the typical lenticular isthmus (Retouched).



Figure VI—Bilateral vas tubes. Few adhesions and no infection of the cul-de-sac. Typical "three ball" shadow. Compare with Figure VII.

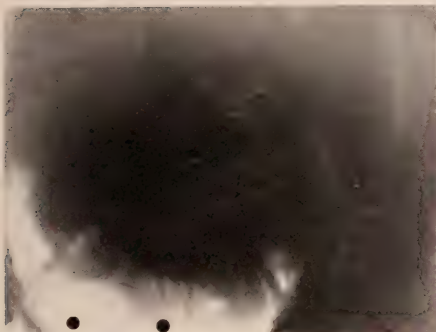


Figure VII—Bilateral purulent salpingitis and posterior pelvic peritonitis. Marked retraction of the culdesac with tension distortion of the broad and round ligaments.



Figure VIII—Hydrosalpinx and haematosalpinx. Some retraction to the left by adhesions. Normal uterus.

intended. The most instructive cases are naturally the "misses" and the detailed discussion of these without an equally full discussion of the "ten strikes" would only serve to give a distorted and fictitiously gloomy impression of the usefulness of this work. A complete discussion of the whole subject is now in preparation.

In the meantime, to my mind, the best evidence of the value of this method and its contribution to pelvic diagnosis lies in the attitude of the Department of Gynecology of the University Hospital under the direction of Dr. R. Peterson. It continues to refer cases in undiminished numbers although the novelty has worn off. The cases are now better selected. The staff is constantly bringing its disputes to the x-ray room for comparison with the stereoscopic image, and they frequently return to the patient with such comments as "We ought to be able to feel that," etc. I am convinced that the method has a distinct field of usefulness in the practice of gynecology as well

as in teaching. That field is not yet clearly defined and its limits can be established only by further experience. It will scarcely develop into a routine procedure or supplant other methods of examination, but I confidently expect to see it occupy an honorable position in the armamentarium of the careful and conscientious surgeon.

Co-operation between the gynecologist and the roentgenologist is imperative. The former will scarcely care to familiarize himself with the laws of projection and stereoscopic vision sufficiently to be independent and the latter can scarcely assume the responsibility of the surgical procedure necessary or the selection of cases.

Such co-operation in unusual measure has been our good fortune. I cannot over-emphasize my obligation to Dr. Peterson and his entire staff in this respect. Their industry is enormous and their interest unflagging. The procedure has been reduced to a routine that is highly satisfactory and we are accumu-

lating a mass of data that promises to be very valuable in the near future.

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DISCUSSION

DR. WM. H. STEWART, *New York*. The doctor has covered the subject so well that I have little, if anything, to add. I would like to say a few words in reference to the general use of pneumoperitoneum. Pneumoperitoneum has come to stay, irrespective of the opinions of some throughout the country. We all know the difficul-

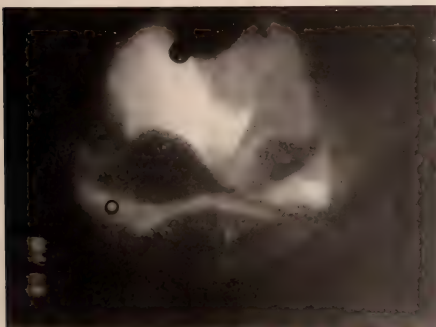


Figure IX—Enlarged, prolapsed and adherent ovary. The retraction is apparent on the flat plate. The fixation to the floor of the pelvis can be appreciated only on stereoscopic examination. No. 39091.



Figure X—Adherent retroversion and retroflexion. Note the shadow of the lower segment reaching forward from the uterine shadow and deforming the pelvic floor. Ovaries enveloped in adhesions (Retouched) No. 39063.

ties that any new method has. I think you can well remember how the man who advocated lumbar puncture was treated for a number of years before the thing was really recognized for its value.

Pneumoperitoneum has its limits and must not be used promiscuously. The cardinal rule to follow is never to use pneumoperitoneum when the same information can be obtained by simpler means. If you decide to use pneumoperitoneum, you must be as careful about the procedure as though it were a surgical operation, and the man who inflates the peritoneal cavity must be as competent to do so as one who is as competent to do laparotomy.

I do not feel, and never have, that the roentgenologist is sufficiently experienced in that line to be able to do his own inflation. I never assume that responsibility. Dr. Stein does it. I have enough responsibility at my end without assuming that.

There have been a great many throughout the country who have been subjected to this method of examination. I do not know accurately how many. I should say at least two or three thousand. As near as we can ascertain, there have been four deaths which have been ascribed to this procedure. Two of them would seem to be a fault in the technique. One was a puncture of the spleen, as near as I remember it, and another was a septic case. Both were avoidable. The other two could not be ascribed directly to pneumoperitoneum, and were not proven to have been caused by it; there was, however, suspicion, not confirmed by post mortem, that pneumoperitoneum was the cause of death in these two cases.

Granting that is so, I believe that the successful issues would far overcome any such mortality as that. Probably, granting that, two cases in three or four thousand. Certainly in many, many instances, it has avoided exploratory operation. We expect to have it knocked. It will be until it is generally accepted in its proper sphere.

The men who are after it are those who do surgery. I find this right in my own hospital, but I would like to say that one of the most rabid men against pneumoperitoneum, right in my own hospital, who stated in one of his discussions on the subject that he would rather submit a patient to two exploratory incisions than to have pneumoperitoneum done on any case, now refers his patients to me for that procedure.

What most impressed him was in the differential diagnosis between splenic and kidney tumors, by which we were able to say whether he should operate from the back or from the front.

There is a great field for this work. Some of the recent developments are sub-diaphragmatic. This is of particular value in sub-diaphragmatic conditions. An investigation of the esophagus at the cardia, with the addition of a pneumoperitoneum, is going to bring out a detail in that area that has never been accomplished before.

I am sure you all appreciate, those of you who do considerable esophagus work, how difficult it is to say whether a certain case is spasmodic or whether it is due to some organic lesion.

By the aid of the ordinary barium or bismuth mixture, combined with pneumoperitoneum, a detail is provided which certainly is far-reaching in its

value in this particular point. Thank you. (Applause.)

DR. B. H. ORNDOFF, *Chicago*.
Members of the Society: I was very pleased, indeed, to hear the splendid remarks of the two preceding speakers. The subject of the use of pneumoperitoneum in connection with examinations of the pelvis, as previously stated, limits somewhat our discussion.

While it is one of the most useful phases in connection with pneumoperitoneum, much could be said of the other conditions that may arise with it.

A recent paper by Dr. Woolston upon a gynecological aspect of work done in the county hospital of this city, corroborates very nicely the paper of Dr. Van Zwaluwenburg. I think, as the previous speaker has said, that the method has come to stay. No criticism which may have been placed upon it recently will have anything to do with it other than to make it a more sound method for our future diagnosis.

The previous speaker discussed some other phases of pneumoperitoneum, of work in which pneumoperitoneum is useful, and I might take the liberty of mentioning one other thing and that is the use of a peritoneoscope in connection with pneumoperitoneum. I feel that before the early work of Doctor Stewart, showing us that pneumoperitoneum could be done without danger, that we have through the peritoneoscope a nice addition to our diagnostic armamentarium.

There are not many cases, perhaps, in which the diagnosis may depend altogether upon the findings from the peritoneoscope, but there are a good many conditions in which it may be used to considerable success. I feel that the question of apparatus to assist in this work has not been sufficiently developed.

Dr. Van Zwaluwenburg showed a very nice arrangement of a table in connection with examinations of the pelvis, but for examinations of the sub-diaphragmatic space, as previously referred to, and for organs where the patient must assume different positions and where the angle of the x-ray must come from different sources in order that we may obtain the best diagnostic view, will require apparatus that is not best adapted for this work.

Many articles have appeared on this subject. It would take considerable time to reiterate the various phases that come to my mind. I would like to close by saying that not only in phases of gynecology, but in abdominal diagnosis in general, there is no doubt that the pendulum will balance very soon, and it will become a thoroughly established method of diagnosis. Thank you. (Applause.)



Figure XI.—Photograph showing table and position used in making plates of the female pelvis after pneumoperitoneum.

DR. LEROY SANTE, *St. Louis, Mo.* I would just like to add our little experience in pneumoperitoneum to that of the former speaker. We have had from one hundred and seventy-five to two hundred cases and no untoward effects from the induction of pneumoperitoneum in any single case.

The difficulties you are liable to get into fall very closely into two or three groups—the possibility of perforating a hollow viscus, the gut, is largely dependent on the pathology you have in the abdomen. If you have a gut that is adherent to the anterior abdominal wall or massive adhesions, then you may have this possibility. If the guts are free, I do not think it possible to insert a needle into the gut. If there are adhesions dense enough to hold the gut to the entry of the abdominal wall while inserting the needle, you do not need to fear if you do insert the needle into the gut.

The next thing is, of course, subcutaneous emphysema. You find the axilla at the side of the neck filled up with air. That does not happen today with the methods of determining when you are inside the abdomen. That causes no ill effect whatever. While we have had it in a few of the earlier cases, we have not encountered it in the last one hundred and fifty cases. The possibility of entering a blood vessel is something that you have to consider.

On one occasion, due to faulty apparatus, and because we did not adhere to the rule of Dr. Stewart to have some one competent to insert the needle, we had bleeding from the end of the needle and the needle was within the abdominal cavity. We withdrew the needle, put the patient to bed and he suffered no ill effects. We gave him another pneumoperitoneum the next day and then operated. There was no bleeding in the abdomen.

PRESIDENT WILLIAMS. Dr. Van Zwaluwenburg, will you close the discussion. A note has been sent to the desk to ask you to explain the technique of the apparatus used in the closing discussion.

DR. VAN ZWALUWENBURG. Answering the note first, do they want the radiographic technique or the technique of the inflation?

PRESIDENT WILLIAMS. The apparatus you use and how you use it.

DR. VAN ZWALUWENBURG. This is obtained from a paper by Dr. Peterson in the last *Journal of Obstetrics and Gynecology*. It is discussed better than I can tell you. The injection is made about an inch below and just to the left of the umbilicus. No preliminary anesthetization is used. A monometer and a gasometer is used to let you know how much we introduce through the belly.

If made in the hospital, a special cannula described a year and a half ago by Dr. Ruben Peterson at the Minneapolis meeting is used with the same preparation, and the limits as to the amount of pressure that can be used are all pretty well discussed in Dr. Peterson's paper. Look for it there.

Now, I can add at least one more case to Dr. Stewart's list of four deaths, not one of my own, but I know there has been a fifth death. There is no use blinding our eyes to the fact that deaths have occurred.

It is also well to remember that a method in comparison with another method must be safe in proportion as we get an inverse ratio to the amount of information we can get. Put it that way.

The exploratory operation may be dangerous, but it is certain to give a

great deal of information that the x-ray cannot give. Therefore, the x-ray man has a clear obligation to prove his method safer than the exploratory method and safer by so much more, as the method is less instructive. Until we can do so, we must leave the question unsettled except in certain cases where, for instance, nobody would think of an exploratory operation, yet he wants definite information for the express purpose of avoiding an exploratory operation. There is a large field for the inflation of the pelvis.

Perhaps the best evidence of the value of the method lies in Dr. Peterson's address. Dr. Peterson is essentially a fairly careful conservative man. He has spent many years in the practice of gynecology. He has a wide acquaintance in the profession and he is going to be pretty careful of his reputation. At first he undertook this purely as an experiment. As things have gone on, he has become more and more enthusiastic, but he selects his cases. We are getting as many cases now as at the beginning. They are more carefully selected.

An interesting feature is that he has lately been compiling the statistics as to the correctness of the gynecological diagnoses, x-ray diagnoses, as compared with the operative findings. It is interesting to note that for the first half of this period the x-ray diagnoses were approximately as good as they were in the last half. The clinical diagnoses, by virtue of the influence of the x-ray, had improved by fifteen per cent. The surgeon, in other words, is reaping the harvest of benefit from this method. We are doing as much of it as before, and Dr. Peterson feels perfectly confident the method is safe in his hands and those of his assistants. The method is dangerous, of course. People might die from puncture of the abdomen.



Pulmonary Syphilis*

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PULMONARY syphilis is a sufficiently rare clinical condition to justify a short resume of the literature on the subject.

In 1822 Morgagni ⁽¹⁾ described a condition which he termed "Phthisis Luevenerea" and its cure by anti-syphilitic treatment. In 1853, Depaul ⁽¹³⁾ read a paper on "Congenital Syphilis" and gave a good anatomical description of the condition. Two years later Vidal in his treatise on venereal disease devoted some space to pulmonary syphilis. In 1862 Virchow ⁽²⁾ reported a case that clinically and later at autopsy showed syphilis of the lung. Fourier ⁽³⁾ in 1876, lectured on pulmonary syphilis; and in 1877 Porter read the first paper on the subject in America. During the later years of the nineteenth century cases were reported in the Transactions of the Pathological Society of London by Hutchinson, Pierson and Weber (1891). Up to the present time probably the most complete discussion and bibliography of the subject is that of Beriel ⁽⁶⁾ in his article on "Syphilis des Poumons" Paris, 1907.

The rarity of the condition is well evidenced by the following figures: In the study of pathological specimens of the Old London Museum, J. K. Fowler ⁽⁴⁾ found only twelve specimens, two of which were questionable. Osler in a report on two thousand eight hundred autopsies at Johns Hopkins Hospital found only twelve cases, eight of which were congenital. In a report of twenty-five thousand autopsies Beriel ⁽⁶⁾ found only two cases of pulmonary syphilis, and among four thousand eight hundred and eighty autopsies, three hundred and fourteen of which showed lesions due to syphilis, Symers ⁽⁷⁾ found only twelve with a lung involvement; and in a careful review of the literature from 1905 to 1917, Dexter ⁽⁸⁾ showed only nineteen undoubted cases of syphilis of the lung reported. In the last ten years, however, with the discovery of the spirochaeta pallidum, the Wassermann test, and the use of the x-ray in the interpretation of diseases of the lung, our knowledge of pulmonary syphilis has been greatly advanced. Many men, particularly clinicians, consider it much more common than we formerly believed; and as Ford Morris ⁽¹⁴⁾ effectively states, "the pale spirochaeta nestles and breeds within the tissues of

a large number of people, and pulmonary pathology of syphilitic origin is not so rare as some believe."

Fowler ⁽⁴⁾ classifies syphilitic diseases of the lung as follows:

HEREDITARY TYPE—

1. Gummata.
2. Pneumonia.
 - (a) White Pneumonia
 - (b) Interstitial type of Pneumonia.
 - (c) White Broncho-Pneumonia.

ACQUIRED TYPE—

1. Gummata.
2. Broncho-Pneumonia.
3. Chronic Interstitial Pneumonia or Fibroid Induration.
4. Syphilitic Pythsis, a Progressive Destruction of the Lung.

Taking up these subdivisions more in detail:

HEREDITARY TYPE

1. *The Hereditary Type:* White pneumonia is found in the lungs of premature infants who live only a short time. These children are markedly cachectic, and have, on post mortem examination, other lesions of syphilis. The lungs are found to be airless, are increased in size, and show the indentations of the ribs over the parts involved. One or both lungs may be affected and the involvement may be generalized or localized. On section it has a whitish, grayish, or marbled red color, but the granular appearance of typical pneumonia is absent. Microscopically the interstitial tissues are not increased, although the alveolar walls are markedly thickened and the alveoli in the small bronchi are filled with epithelial and inflammatory cells, some of which are in the process of breaking down. In these cases characteristic clinical signs of inherited syphilis are nearly always present.

2. *The Interstitial Type of Pneumonia* is a more advanced stage of the white pneumonia. The lungs are large, hard, dark gray in color and on section show a coarse appearance due to an increase in the interlobular connective tissue. Microscopically there is round cell infiltration, particularly about the small bronchi. The arteries occasionally show luetic arteritis.

3. *White Broncho Pneumonia* is extremely rare, resembles the broncho-pneumonia of other causes except it has a clear white appearance that can be seen and recognized microscopically. It occurs primarily in the small bronchi, the alveoli being involved secondarily.

ACQUIRED SYPHILIS

1. *Gummata:* The gummata are found singly or in large numbers and vary in size from a pin head to an egg. They are usually situated in close relation to large fibrous septa of the lung, especially at the root, less often near the pleura, and rarely at the apex. Gummata of the lung generally become fibrous, rarely they soften and ulcerate into the bronchus. Microscopically the gummata are of the same structure as gummata in other parts of the body. So far as I have been able to find in the literature spirochaetae have not been demonstrated in these gummata.

2. *Syphilitic Broncho Pneumonia* of the second group is held by most authorities to be a doubtful condition.

3. *Chronic Interstitial Pneumonia:* This group comprises those cases in which the fibroid changes are characteristic. The involvement may be local or general. The parts affected are retracted and radiate on the radial lines of connective tissue from the hilus of the lung. If the condition is found localized about the hilus there is a fibrous, syphilitic peri-bronchitis, and an enlargement of the bronchial glands.

4. *Syphilitic Phthisis:* By some this is considered a rarity and by others the most common condition. It is a mixed condition consisting of fibrous tissue formation, gummataous changes, consolidation, cavitation and bronchiectasis. It resembles tuberculosis in every way except that lues tends to affect tissues particularly about the bronchi and hilus of the lung.

In order that a case may be diagnosed as pulmonary syphilis, Fowler ⁽⁴⁾ demands: First, that the case must be complete. That is the symptoms during life must be considered in connection with the lesions discovered post mortem. Second, that there be evidence of undoubted syphilitic infection. Third, that tubercle bacilli be absent from the sputum on repeated examination and from the lung tissue on post mortem examination. Fourth, that syphilitic lesions about which there is no doubt will be found in other organs. To these may be added the demonstration of a positive Wassermann reaction and improvement following luetic treatment. From this it will be seen that positive diagnoses of lung syphilis will be few and far between.

CLINICAL MANIFESTATIONS

In hereditary syphilis the lung symptoms are overshadowed by those of the liver, spleen and skin. There may, however, be dyspnea and cyanosis,

*—Read at Omaha and Douglas County Medical Society.

with a difference in the resonance in some part of the chest. Even with energetic antisyphilitic treatment these cases rarely live more than two or three months.

ACQUIRED FORM

A great deal more is known about the pathology of lung syphilis than is known about its clinical manifestations. There may be a latent form in which gummata may be present and give no signs or symptoms. The patient may appear to be in good health and in a good state of nutrition, or may complain of nothing except a slight cough, the physical examination reveal only a slight area of dullness and the x-ray examination show a typical shadow near the hilus of the lung. It would be wise, therefore, considering the accounts of cases that have been reported, to view with suspicion patients with trivial lung findings, with other definite lesions of lues."⁽¹⁰⁾

Cases of ulcerating gummata have been reported by Beriel, in which there was fever, wasting sweats, foul abundant sputum with occasional pieces of tissue, and on physical examination a patch of dullness at the angle of the scapula with definite, limited rales. In these mercurial inunctions caused a prompt improvement.

In luetic phthisis the onset is insidious, and until markedly developed, differs but little from tuberculosis. Symptoms such as cough, tachycardia, gastric disorders, etc., which have been shown by Pottenger⁽¹⁸⁾ to be due to a reflex stimulation of the vagus, are not present in lues until the later stages, when the involvement of the bronchial glands becomes more marked and causes the stimulation. If coughing is found early in pulmonary lues it is due to laryngeal, tracheal or bronchial lesions.⁽¹⁰⁾ Dyspnea is a very common symptom that may be severe, due to stenotic involvement of the trachea and bronchi. Hoarseness may be present from the involvement of the larynx. Hemoptysis is less common than in tuberculosis, probably due to the chronic obliterative endarteritis present. Lissner and Remsen⁽¹⁵⁾ have reported a fatal case. Night sweats and fever are sometimes present, although early in the course temperature is absent. Later a variable type of temperature may be present.⁽¹⁷⁾ It may be of a septic, intermittent or remittent type.⁽¹¹⁾ Emaciation is gradual, but not nearly so marked as in tuberculosis. The fibroid form may be latent until right heart failure supervenes, and clinically may not be distinguishable upon physical examination from that due to tuberculosis. Osler⁽⁵⁾ and Perry⁽¹⁵⁾ have each reported a case presenting

DIAGNOSIS

The diagnosis of pulmonary syphilis is a diagnosis by elimination, as there is nothing absolutely characteristic in the clinical history or in the physical signs. They are the signs associated with infiltration and fibrosis of the lungs with or without bronchiectasis, as the case may be. Many cases of lung syphilis are pronounced hopeless tuberculosis, and as Virchow⁽²⁾ tersely stated "Some patients die of so-called tuberculosis for lack of anti-syphilitic treatment."

Tuberculosis and syphilis may co-exist. In differentiating between these two conditions it is well to remember, first that tuberculosis affects the apex and subsequently the apex of the lower lobe and progresses along a certain route, while syphilis is prone to involve the hilus and the base. Second, that tuberculosis tends to cavitation, syphilis to fibrosis, even the pulmonary gummata rarely break down. The cavities found in tuberculosis are due to destruction of lung tissue, but may also be due to bronchiectasis. Cavities found in pulmonary lues are usually bronchiectatic. Third, syphilis frequently causes stenosis of trachea or bronchi,

tuberculosis very rarely does. Fourth, tuberculosis lesions are common, syphilitic lung lesions rare, and lastly, syphilis is more frequently unilateral and circumscribed than tuberculosis.

I have not been able to find in the literature that spirochaetae have been demonstrated in the lung tissue. In D'Arcy Power's "System of Syphilis" a case is reported in which spirochaetae were found in the sputum, but, when one considers all the spirochaetae to be found in the mouth one realizes how extremely difficult it would be to differentiate it.

The x-ray is invaluable in the diagnosis of pulmonary syphilis, frequently revealing the flame-shaped shadow about the hilus with the fibrous strands running out along the septa. This picture, although not absolutely characteristic, is very different from that due to tuberculosis.

The physical signs, like the symptoms, are not characteristic, but depend upon the character and location of the lesion. Many things may help in more frequent discovery of this supposedly rather rare condition, and among these are the following: the presence of symptoms referable to the lungs, the



Figure 1—Before treatment, April 28, 1918.

absence of tubercle bacilli upon repeated examination, the history of syphilitic infection, plus the presence of other manifestations of syphilis in other parts of the body, or the presence of a positive Wassermann reaction, and, as Lissner says, ⁽¹⁰⁾ "the lack of proportion between the gravity of the physical findings, the severity of the symptoms, and the astonishingly good appearance of the patient," and the bearing in mind what Virchow ⁽¹²⁾ has said, which we have already quoted.

PROGNOSIS

If the disease is not recognized in time the emaciation will become marked, lesions in other viscera will occur, and death may result from general weakness or from complications. It is surprising how much can be done, however, even in markedly enfeebled patients by prompt anti-syphilitic treatment.

Pulmonary lues lessens the resistance of a patient and renders him more liable to tuberculous infection. When tuberculosis is added to an active, virulent syphilis the tuberculosis pursues a very rapid course; but when tuberculosis develops in a patient with an old syphilitic infection, the case may be without

fever and tend toward the chronic fibroid type. ⁽¹⁶⁾

TREATMENT

The treatment of pulmonary syphilis is the treatment of syphilis of any part of the body. If pulmonary tuberculosis co-exists the use of potassium iodide should be guarded, for it is well known that potassium iodide causes a rapid breaking down of tuberculous lesions.

The subsidence of symptoms and the clearing up of physical signs does not mean the curing of syphilis. It is a well known fact that it is almost impossible to obtain a negative Wassermann reaction in pulmonary lues. It is inadvisable to consider any one free from syphilis until not only the blood Wassermann test, but the spinal fluid Wassermann reaction as well, is negative several years after the last anti-syphilitic treatment. ⁽¹¹⁾

CASE REPORT

F. H. H. First seen April 29, 1918. Age, thirty-one years. Farmer. Married. Wife has borne no children, and has had no miscarriages. His personal history is negative with the exception of a sore on the penis, which disappeared without treatment. Family history negative.

He came complaining of a slightly productive cough, which began about three months before I saw him. This cough was accompanied by a slight pain in the right chest, although he stated he had had suggestions of this pain for the past three years. He gave a rather doubtful history of night sweats and slight loss in weight. A diagnosis of tuberculosis had been made.

Physical examination revealed a man six feet tall, weight one hundred and thirty-eight pounds. Head and neck negative. Heart, normal. Abdomen negative except for a small epigastric hernia. Reflexes normal. Urine, negative. The blood showed a normal white count. Normal picture on stain. Slight evidence of a secondary anemia in the red count. Stomach analysis normal. Von Pirquet test slightly positive.

During an observation of two weeks in the hospital his temperature never rose above one hundred and his sputum failed to reveal tubercle bacilli upon repeated examination. The blood Wassermann reaction was four plus.

Examination of the lungs showed a slight difference of expansion between the right and the left, the right seeming to lag toward its base. Palpation, negative. Percussion, questionable hyperresonance about the region of the right fourth to the sixth rib in front. Auscultation, breath sounds were slightly increased over this area. No rales were demonstrable. X-ray examination showed the typical flame shaped consolidation about the hilus and the fibrous septa running toward periphery of the lung.

On May 7, 1918, his weight was one hundred and thirty-six pounds, and at that time he was given nine-tenths of a gram novarsenobenzol and put on mercurial inunctions with large doses of potassium iodide.

On May 16, 1918, his weight was one hundred and forty-one pounds. He was given nine-tenths of a gram of novarsenobenzol.

On May 23rd he was given another injection and again on May 29th. After each injection his chest was examined by x-ray. Each time there was a definite lessening of the shadow found on the first examination.

He left the hospital for his home at this time and reported again on June 15th for an injection of nine-tenths of a gram of novarsenobenzol, and on July 7th for another injection of nine-tenths of a gram. His weight at this time was one hundred and forty-six, his Wassermann reaction still positive. He was not seen again until September 9, 1918, when he came in complaining of a slight cough and a trace of blood, which promptly stopped when he stopped taking the iodides. During



Figure II—After treatment, September 21, 1918.

the interval he had continued the mercurial inunctions and the iodides. September 9, 1918, his weight was one hundred and forty-five. He was given another injection of nine-tenths of a gram of novarsenobenzol.

He was not seen again until April 2, 1919, when he reported again, saying he was absolutely normal, and since he was last seen he had continued the mercurial inunctions faithfully six days on and six days off. His physical examination was negative. All symptoms had disappeared. His weight was one hundred and sixty pounds. The Wassermann reaction was still four plus. X-ray examination at this time showed still more marked improvement.

On May 8, 1919, his weight was one hundred and sixty-two pounds. He was again given nine-tenths of a gram novarsenobenzol, and on May 29th he was given another injection of nine-tenths of a gram. Physical findings and clinical symptoms had entirely disappeared, and as he said he saw no reason to continue treatment he disappeared from observation until March, 1920, when he told me in answer to my letter of inquiry that he was feeling absolutely well; his weight was one hundred and eighty pounds.

He was seen last on September 10, 1920. Weight one hundred and

seventy-five pounds. Wassermann test still three plus, although physical examination was entirely negative.

CONCLUSION

If we were to follow Fowler's postulates this case could not be considered as pulmonary lues, for no post mortem has been performed, nor were there other clinical manifestations of lues found, but Fowler advanced these postulates before the advent of the Wassermann test and the use of the x-ray.

The definite history of syphilitic infection and the repeatedly positive Wassermann reaction is enough to convince us that this man had lues. However, it is not unusual for lues and tuberculosis to co-exist in the same individual, but the gradual onset, the slow course, the physical findings at the base and hilus, with little fever, are not those of tuberculosis. This, combined with the repeated absence of tubercle bacilli, the positive Wassermann reaction and the typical x-ray findings, with definite change in the physical and x-ray findings under treatment, combined with the marked improvement in the general physical health (the weight increasing forty-four pounds), are sufficient to our mind to prove this case one of pulmonary lues.

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Hyperthyroidism, Basal Metabolism and Radiography*

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THE relation of a pathological condition, an exact laboratory method of estimating the severity of this pathological condition and the applicability of a remedy with which we, as specialists, are peculiarly interested, must bespeak our careful attention.

Hyperthyroidism is a condition that is much more common than is generally supposed. When we consider that appreciable enlargement of the neck is not necessary for hyperthyroidism to be present in even advanced degree we welcome any method of precision in establishing an exact diagnosis. I do not refer entirely to substernal thyroids, which if looked for are not difficult to detect, but to cases which are seen frequently with no appreciable enlargement either above or below the clavicle but giving a plus test for basal metabolism. Many patients of this kind wander from one medical man to another

with varied diagnoses, the principal ones being neurasthenia and disease of the heart muscle. A little care in the study of these cases will many times result in a score where before there has been repeated failure.

Of the conditions that must be considered in a study of the thyroid, but not applicable to this paper, we must think of adolescent goiter and malignant disease. We have remaining adenomata, colloid goiter and primary and secondary hyperthyroidism.

Too much attention has been given to so-called characteristic symptoms of hyperthyroidism: exophthalmos, goiter, tachycardia and tremor. Several of these signs may be absent and others only obscurely present, and still the person almost invalidated from the systemic effect of this disease. Note should be made of the lesser symptoms as their value has been under-estimated. Almost absence of winking, the usual staring of the eye, nervousness, unusual perspiration, mental irritability and a slight but gradual loss of weight are

early symptoms not to be overlooked. In such cases tests of basal metabolism are of the greatest value.

I have learned to consider the result of such test, properly safeguarded, to be as reliable as the better known ones of blood pressure or even the thermometer. This is true in a negative as well as in a positive way. Cases with apparently cardinal symptoms have shown a normal metabolism, while subsequent history has proven them to have malignant or some other non-thyroidal disease.

The effect of x-ray or radium upon all cell activity does not need to be proven here. In proper doses its inhibition is without exception. These doses vary with different kinds of tissue, but the rule holds true. Because one operator, giving an inappropriately small dose of x-ray, stimulates an epithelioma, while another destroys with a proper dosage, the rule of inhibition is not disproved. The same is true in thyroid cases; there is a proper dose and it must be given if one is to suc-

*—Read at the annual meeting of The Radiological Society of North America, Chicago, December 9, 1921.

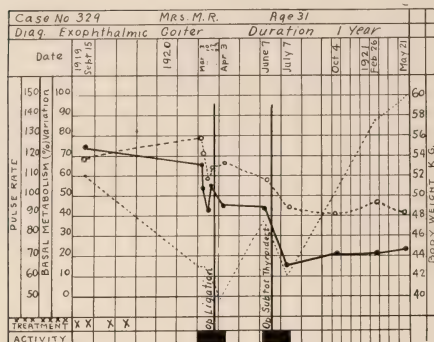


Figure I—Case No. 329. Exophthalmic goiter. Graphic chart showing change occurring in the basal metabolic rate and pulse. X-ray treatment indicated at the bottom by a cross.

ceed. Many combinations of the variable elements of technique of radium or x-ray treatments will succeed. As practical workers, we like to know just how the other man, who claims success, treats his cases, I will give my technique as one of the satisfactory combinations:

Three and one-half milliamperes, fifteen minutes, four and one-half mm. aluminum filter, eight and one-half inch spark gap, sixteen inch distance, six treatments on each side of neck (twelve treatments in all) given twice a week. You will note this is the old fractional method. It has served me well for many years. I believe this method causes less disturbance during the period of treatment; the permanency of the effect is better and there is almost no danger of skin reactions. A few of my cases, during the last fifteen years have been re-treated. I do not look

upon this as a catastrophe. On the other hand, none of them have had myxedema. It might be well to add for comparison with surgical statistics that I have had no deaths. Nature is one of our best allies and the system adjusts itself to a certain degree of over or under stimulation, so it is found that we can be almost empirical in our dose, not varying it for the individual very much, but allowing this to be taken care of by the reciprocal action of the body.

I would not be understood to assert that all cases of hyperthyroidism yield to radiation, but the cases upon which favorable action is absent are few.

The main object of this paper is to bring out the relation between the three parts of my subject. Just how important is basal metabolism as a test for hyperthyroidism so that we may treat it intelligently with radiation? I be-

lieve fully one-sixth of the cases sent to me for this laboratory test are negative; clinically they are more than suspicious, too much so to neglect the test in justice to the patient. On the other hand, I believe that in another sixth of the cases seen the error has been made in the other way. A positive test is secured on patients who, naturally, have been sent by the last consultant for this condition, but previously have seen two or more of the profession who failed to become suspicious enough of the thyroid to have the test made or even treat them for the condition. So here is a plea for a careful basal metabolism test in all cases where a diagnosis of hyperthyroidism is made and also for this test in many cases of obscure nervous or supposed cardio-muscular disease. A word here can be interjected concerning the argued question of whether this test should be a laboratory pro-

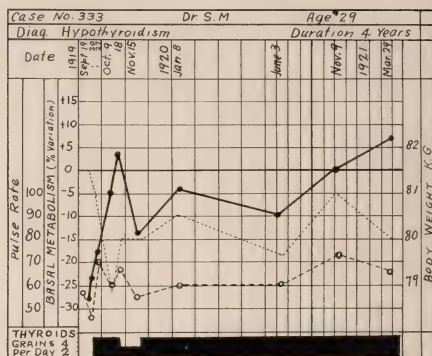


Figure II—Case No. 333. Exophthalmic goiter. Graphic chart showing change occurring in the basal metabolic rate and pulse. X-ray treatment indicated at the bottom by a cross.

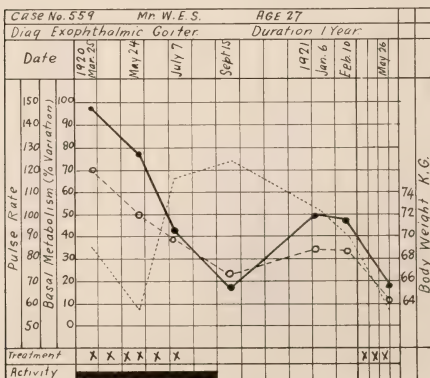


Figure III—Case No. 559. Exophthalmic goiter. Graphic chart showing change occurring in the basal metabolic rate and pulse. X-ray treatment indicated at the bottom by a cross.

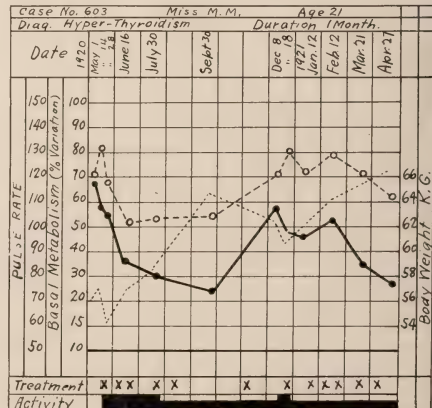


Figure IV—Case No. 603. Exophthalmic goiter. Graphic chart showing change occurring in the basal metabolic rate and pulse. X-ray treatment indicated at the bottom by a cross.

cedure, or is the necessity for absolute rest so great that it must be done at the bedside at home or in the hospital. My observation agrees with many others that an hour of rest, both mental and physical, is sufficient to insure accuracy, and that more extended quietude changes the result very little. Every effort should be made to have the patient look upon the procedure as simple and unimportant and not out of the ordinary. For this reason, I believe, when easy of accomplishment, tests taken at the home are better, and next to this the laboratory if it is well fitted up for the rest required by the patient. Going to a hospital over night, to many patients, is in and of itself a cause of undue mental disturbance and loss of sleep.

Now, the question comes, when shall the test be made again upon the patient undergoing radiation. While I know this is done by many at fairly frequent intervals, I have made a careful study and believe the pulse can be depended upon to tell the changes that are occurring in hyperthyroidism almost as accurately as the test of basal metabolism. The pulse should always be taken when the patient is in the same position and other facts should be the same. It is my custom to talk with the patient just before the treatment as they are on the treatment table, fingering the pulse during the entire conversation. In this way one can get the approximate rate practically without the patient's knowledge. I believe no metabolism tests, in the majority of cases, are necessary until

the final one, a month after the last treatment.

I have tried to show you the feelings of an independent worker as to the relation of the three parts of my subject, namely: A dependable treatment for a disease not easy to definitely diagnose, except for the newer laboratory method advocated.

In furtherance of the idea of the accuracy of the pulse as an indication of the effect of treatment, I will present to you, with the permission of Dr. James H. Means of Boston, the charts he showed at the A. M. A. meeting in June. These charts were not shown for the above purpose, but they illustrate it so well that by showing them instead of my own I am not left open to the criticism of bias.

Control of X-Ray Therapy in Hyperthyroidism by the Basal Metabolism Test*

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THE metabolism of the living organism may be defined as the sum total of the chemical changes going on in the cells of its body. These chemical changes involve the absorption of oxygen and the elimination of carbon dioxide and nitrogenous waste products. Heat and muscular effort are the energy manifestations of this chemical interchange, and the amount of work and heat so manifested is directly proportional to the rate at which this chemical interchange takes place.

Therefore, to measure the rate of metabolism, it is necessary to measure either the rate of heat production or the rate of the chemical interchange above mentioned. Although the heat and work resulting in a given period of time are capable of exact measurement (by direct calorimetry) it is clear that to measure the chemical interchange would be far more easily accomplished (indirect calorimetry).

In practice the nitrogenous excretions need not be considered, since their increase or decrease does not effect appreciably the other two factors, namely, the oxygen intake and the carbon dioxide output.

To simplify the process still further, it is also unnecessary to measure the carbon dioxide output, since the ratio between the heat and work, that is, the metabolism, and the carbon dioxide output is not appreciably altered by the increase or decrease in the carbon dioxide

eliminated in conditions in which the test is of value.

There remains, then, only the task of measuring the oxygen intake, and nowadays, when we speak of measuring the rate of metabolism, we think of it in terms of measuring only the oxygen part of this chemical interchange. In other words, a measure of the rate of oxygen absorption is practically a measure of the rate of heat production, that is, metabolism.

It is for this reason that the old-time gas analysis method has not met with more favor, since even the greatest amount of error which can result from neglecting to take into account the carbon dioxide is only about two per cent, whereas the metabolism itself, in the same individual, varies an average of five per cent from one test to the next, even in the most rigidly controlled conditions. This small percentage of error, fortunately, is of no possible clinical significance.

This method of using the rate of oxygen absorption as an index to the rate of heat production involves a translation of these oxygen units into heat units, or calories. To do this, the heat value of oxygen is taken as 4.825 calories per liter, and by multiplying this factor by the number of liters of oxygen consumed in a given period of time, the number of heat units liberated during this period of time is thus made known. The final result, however, is stated in terms of a plus or minus per cent of the subject's so-called normal rate.

An apparatus (Fig. 1) for measuring this rate of oxygen intake, and also

the method of reading off directly this per cent rate of metabolism, devised purposely to avoid the old-time useless repetitions of these calculations, is described in detail elsewhere.⁽¹⁾

BASAL METABOLISM DEFINED

Muscular work claims a large share in the total metabolism, but since it varies so widely under different conditions, the disturbing influence of its variation must be reduced to a minimum. This is done by having the patient refrain from all muscular effort during the test.

Another variable and therefore disturbing factor which must also be reduced to a minimum is the influence upon the heat output of the body caused by the absorption of food from the alimentary canal. This influence is spoken of as the specific dynamic action of food. It varies with the kind and amount of food and the rate of its absorption. In practice, therefore, to eliminate the variable influences which muscular effort and the absorption of food have upon the rate of metabolism, the test is performed twelve to fourteen hours after the last meal, preferably in the morning before breakfast, and with the patient lying at complete muscular rest for twenty or thirty minutes before the test is made. Under these conditions the rate of heat production, or metabolism of the individual is thus reduced to the minimum necessary to maintain the temperature of the body.

This minimum of heat production is called the basal metabolism. It is a surprisingly constant quantity in individuals

*—Read at the annual meeting of The Radiological Society of North America, Chicago, December 9, 1921.

of the same age and sex, being higher in youth than in adults, and in males than in females. Indeed, the normal rate of metabolism varies less from one individual to another as compared with its variation seen in certain pathological conditions than does the body temperature of normal individuals as compared with the temperature variations observed in fevers.

A concise table has been compiled by Aub and Du Bois giving the various rates of metabolism for both sexes and ages from six to eighty years, so that these factors need only to be taken into account to determine what is normal in any given case. So true is this that when the basal metabolism of a given individual varies more than the arbitrarily chosen limit of ten per cent more or less than the normal for that patient's age, certain diseases may be diagnosed on the basis of this change from the normal rate.

CLINICAL INTERPRETATIONS

Reports of various investigators discussing the uses of the basal metabolism test in goiter conditions have had such prominent place in medical literature of the last two years that those not thoroughly familiar with the subject have come to believe that the rate of metabolism is influenced only in hypo and hyperthyroidism and in exophthalmic goiter. The question most commonly asked is: In what patients other than those suffering from thyroid conditions may the basal metabolism test be useful?

A. The metabolism rate is raised in—

1. Pernicious anemia (as high as plus forty per cent in some cases).
2. Leukemias.
3. Typhoid (mainly because of fever).
4. Pregnancy (about plus twenty per cent at term).
5. All fevers (from plus five to plus ten per cent rise in metabolism for each Fahrenheit degree rise in temperature).
6. Hyperthyroidism (from twenty to forty per cent in mild, forty to sixty per cent in moderate, sixty to one hundred per cent or more in severe cases).
7. Hyperpituitarism, that is, gigantism or achromegaly (up to plus forty per cent).
8. Diabetes (up to plus twenty per cent in early cases, although below normal after the patient becomes emaciated).
9. Cardiac decompensation (up to plus forty per cent).

B. The metabolism is reduced in—

1. Myxedema and cretinism, that is, hypothyroidism (as low as minus twenty-five per cent).

2. Froelich's syndrome of pituitary origin (about minus twenty-five per cent, although in Froelich's syndrome of the eunuchoid type, from which it is most often clinically indistinguishable, the rate is normal).

3. Pathological obesity of hypothyroid or pituitary origin. Although in simple obesity, (the obesity of laziness and big eaters) the rate is normal. In the former, glandular therapy is indicated, but in the latter, thyroid preparations should positively not be used, since thyroxin increases the combustion of muscle tissue instead of fat tissue.

4. Extreme cachexia, as in tuberculosis, diabetes, prolonged starvation, etc., (as low as minus thirty per cent).

5. Persons in perfectly normal health, but running low heart rates, say as low as fifty, may show a metabolism rate as low as minus twenty per cent.

6. Addison's disease (about minus thirty per cent).

Combinations of these conditions may give any kind of a rate, that is, an emaciated tuberculous patient with fever may be low on account of the emaciation or high on account of the fever, or normal on account of both variations counter balancing each other.

Since there are so many pathological conditions which raise or lower the rate of metabolism, the question, therefore, is: Why is the test used only in diagnosing thyroid and pituitary abnormalities? The answer is simply this: All of the above named pathological conditions, excepting those of pituitary and thyroid abnormalities, are diagnosed

far more readily by other more obvious means. Who needs a metabolism test to recognize pernicious anemia, or cardiac decompensation, or a full term pregnancy?

However, suppose a clinician in a suspected case of hyperthyroidism finds the metabolism increased, say, plus thirty per cent. If the patient has four or five degrees of fever at the time of the test, and the clinician does not know that the metabolism is markedly increased by fever he would be easily misled into error in his diagnosis of hyperthyroidism. Therefore, although we do not find a use for the test in diagnosing most of the conditions named above, it is absolutely necessary that we bear in mind that these conditions influence the metabolic rate.

On the other hand, we have no means of recognizing a beginning hyperthyroidism in the presence of symptoms suggesting incipient tuberculosis, or neurasthenia, or the neuroses of adolescence, excepting through the basal metabolism test. For example, the patient illustrated in Fig. 2 was diagnosed by his physician as a "Neuro". Hyperthyroidism was not suspected because of the absence of tumor and exophthalmus. The heart rate was variable, the tremor was attributed to other causes, the loss in weight, although amounting to some fifty or more pounds, had covered a period of two years and the complaint of weakness was considered a part of the general picture of neurasthenia. Having been misled by some recent work on the endocrines in which the statement was made that some forms of neurasthenia are due to hypothyroidism and others to hyperthyroidism, the physician requested a basal metabolism test in this case, in the belief that the patient would show a "hypothyroidism neurasthenia." The test, however, showed a fifty-four per cent increase in the metabolism and a subsequent removal of a substernal thyroid with ultimate return of a normal metabolic rate and complete disappearance of the symptoms confirmed the diagnosis of hyperthyroidism.

Likewise, the two types of Froelich's syndrome can often be distinguished only by means of a determination of the metabolic rate. The patient illustrated in Fig. 3 was exhibited by his physician as a typical case of dystrophia adiposa genitalis of hypopituitary origin. The basal metabolism was normal, however, and the fact that the patient showed tallness rather than dwarfism for his age, and because of the absence of brain tumor symptoms, a diagnosis of eunuchoidism was made.

Addison's disease has often been confused with myxedema, because of the pigmentation of the skin observed



Figure 1—Shows apparatus employed for making basal metabolism estimation as described by the author.

in some cases of the latter, when (if the low blood pressure symptom is doubtful, as from a complicating nephritis) the two can be differentiated only by the therapeutic test, that is, through thyroid therapy, controlled by successive metabolism determinations. The patient illustrated in Fig. 4 had been treated for months on various mixtures of thymus, pineal, and pancreas gland preparation for his ailment which had been diagnosed as Addison's disease because of the marked bronzing of the skin. The adynamia, loss of memory, falling of the hair, and the skin changes, however, suggested hypothyroidism. All of these symptoms disappeared in about three weeks on thyroid gland therapy, the metabolism test showing a rise of the metabolic rate from minus thirty-two per cent to normal.

Patients complaining of recent rapid gain in weight can not be effectually treated until the metabolism rate shows whether the condition is that of the simple or of the endocrine type of obesity. Having determined by the basal metabolism test whether the condition is one of simple or of pathologic obesity, the data obtained from this may then be used to estimate the caloric or dietetic control of the one, and the thyroxin or thyroid gland treatment of the other.

The test is of most value in the borderline cases of hyperthyroidism, and while one seldom requires the test for recognition of the more advanced cases, it is most often in the advanced cases that the test is required to show how the disease in each individual case responds to the treatment—x-ray, rest in bed, ligation, thyroidectomy—and also to indicate which form of treatment in

a given case is the better one to employ at the outset.

Perhaps nothing is more striking than the use of the test in determining whether or not the correct dosage of thyroxin or thyroid preparations is being used in the treatment of myxedema, since these preparations vary in strength from nothing to full potency, and since individuals vary in the amount of the drug they require to bring the metabolism up to the normal basal level. Read Plummer, *Jour. A. M. A.*, July 23rd, 1921.

Another question is often asked: Is it possible to decide by the aid of the basal metabolism test whether or not radical operations may be safely undertaken in moderately severe cases of hyperthyroidism?

Mayo (Surg. Gyn. and Obstetrics, March, 1921) believes that a patient showing a metabolism rate of plus forty per cent is a more dangerous risk surgically when the rate is on the upgrade, than the one whose rate is plus sixty per cent, with the rate on the downgrade, as shown by successive tests, taken a few weeks or days apart. Other factors, that is, the age, the state of nutrition, condition of the heart, etc., are obviously most important, also, in deciding the question of operation.

Surgeons generally object to x-ray treatment for two reasons: First, too much of the gland may be destroyed by the x-ray, thus leaving the patient a victim to hypothyroidism. Second, many patients show absolutely no response to such treatment and the time lost in such temporizing is usually at

the expense of the myocardium, which suffers most of all from the toxicosis.

The radiologist in reply objects to surgery on the same grounds, namely, that the surgeon often removes too much of the gland, leaving the patient a victim to myxedema; also, many patients show only slight improvement, and others who are apparently cured, have recurrences of the disease after surgical removal of portions of the gland.

The effect of treatment in such cases is not so obvious, except to those who have dealt with large numbers of cases and whose results are proven by means other than personal opinion as to the outcome, and wrong diagnosis at the outset. For example, many marvelous cures are claimed by surgeons who remove goiters that are nothing but simple non-toxic goiters to begin with; many internists cure their exophthalmic goiter patients with thyroidectin serum who are not goiter patients at all; and the dabbler in endocrinology boasts of cures made with mixtures of thymus, pancreas, pineal, ovarian, and heaven knows what else extracts, when as a matter of fact the patient's rest in bed is perhaps the only factor in the course of treatment which caused the improvement. Spontaneous cures are not uncommon, and many rush off proclaiming cures, when only a temporary improvement has been achieved.

And so, what with wrong diagnoses at the outset, and mistaken cures at the finish, the physician will have less success of this sort who puts aside personal opinion for definite evidence based on accurate metabolism control of his cases. As Du Bois says, the method of metabolic rate determination has become the therapeutic nihilist in the treatment of the goiter patient.



Figure II—Case illustrating the advantage of using basal metabolism estimation to distinguish between neurasthenia and hyperthyroidism. Metabolic rate plus fifty-four per cent. Surgical removal of the sub-sternal thyroid gave relief.



Figure III—Patient illustrating the value of basal metabolism estimation to distinguish between dystrophia adiposa genitalis of hypopituitary origin and eunuchoidism.



Figure IV—Patient illustrating the value of basal metabolism estimation to distinguish between Addison's disease and hypothyroidism.

IS HYPER-SECRETION OF THE THYROID REDUCED BY X-RAY TREATMENT?

The multiplicity of opinions of former days for and against the use of the roentgen ray in the treatment of hyperthyroidism came about from, first, the irregularity of dosage and the variations in the technique of different operators, and second, the need of some method of determining whether or not the patient's supernormal rate of metabolism returned more nearly to the normal, coincident with the actual or imagined improvement in the clinical symptoms following such treatment.

That the secretion of the thyroid gland may be diminished by x-ray treatment is no longer questioned. Normal individuals in whom a diagnosis of hyperthyroidism has been erroneously made, have been rendered victims of hypothyroidism with single moderate doses, and even extremely toxic hyperthyroid individuals have developed hypothyroidism following repeated massive doses. The question of successful treatment, therefore, is one of correct dosage. It has been commonly observed that some patients become distinctly more toxic through repeated small doses, undoubtedly from the stimulating rather than destructive action of such treatment. On the other hand the single large dose is dangerous to the patient within the twenty-four hours following the exposure. The immediate effect of such large doses is seen in the markedly increased irritability, even to the point of temporary dementia, and an increase in the already too rapid heart rate, even to the point of cardiac failure.

No attempt will be made here to review the various reports which have accumulated in the last seven or eight years on this subject, some two hundred of which have been catalogued by Ludin.⁽²⁾

Seymour⁽³⁾ summarizes the advantages of the method of roentgen ray treatment of hyperthyroidism as follows:

1. There are no fatalities.
 2. There is no resulting scar, as after operation.
 3. It does not interfere with the patient's occupation.
 4. It is painless and causes very little inconvenience to the patient.
 5. If unsuccessful, an operation may be performed with less work because of the favorable action of the roentgen ray on the thyroid gland.
- Means and Aub⁽⁴⁾ believe that "the chance of cure in exophthalmic goiter is as good with the roentgen ray as with surgery, in groups of equal toxicity." They give preference to the roentgen ray method, since the danger

of a fatal outcome is less, and they believe that surgery should be employed only after the roentgen ray and other methods have failed.

It has been the privilege of the present writer to follow the effects of x-ray treatment in a number of patients under the care of Dr. Charles Spencer Williamson and of Dr. R. H. Babcock, both of Chicago, by determining from time to time whether or not such treatments resulted in a return of the basal metabolism to the normal. Both of these men are of the opinion that in selected cases the x-ray method of treatment is undoubtedly superior to surgical operation. Cases were encountered in which the rate of metabolism did not return entirely to the normal level, but these were, nevertheless, distinctly benefited, so that thyroidectomy could be undertaken later with less danger.

The objection to the use of the x-ray on the ground that it renders surgery more difficult because of the dense adhesions produced by the x-ray, is not a serious one, at least, when compared with the advantages to be gained. It is significant to note that many patients who come in for x-ray treatment have previously been operated upon.

The most valuable single contribution of recent date on the subject of x-ray treatment in hyperthyroidism is perhaps that of Means.⁽⁵⁾ The characteristic return of the basal metabolic rate more and more nearly to the normal, following each exposure to the x-rays, is graphically represented on charts for a number of the cases reported. The paper also discusses much of practical value pertaining to the general subject of basal metabolism and its clinical interpretations.

CONCLUSIONS

1. Hyperthyroidism is due to a hypersecretion of the thyroid gland. The more the secretion, the more pronounced the symptoms. The value of a given method of treatment, therefore, is proportional to its effect in suppressing this hypersecretion.

2. Also, the more the secretion, the higher the basal metabolism. The value of a given method of treatment in suppressing this hypersecretion, relieving the symptoms, and reducing the basal metabolic rate, may, therefore, be shown by following its effect on the metabolic rate, since the symptoms themselves are more variable among different individuals than is the metabolic rate.

3. The favorable reports of some hundred or more investigators show that the roentgen rays have a curative effect in hyperthyroidism.

4. Its value depends, just as it does in the surgical treatment of the same condition, upon the technique, pre-

vious experience, and judgment of the operator.

5. The most important uses are (1) in the treatment of cases showing minor degrees of toxicity, and (2) in reducing the extreme toxicity in the more severe cases preliminary to surgical removal of the gland.

6. Even though not all patients respond to this method of treatment, which is likewise true when surgery is employed, the majority of them show distinct improvement clinically, the heart rate is diminished, the tumor is reduced, the nervous symptoms are improved, and the basal metabolism returns more nearly to the normal rate.

7. That a more perfect system of dosage has yet to be developed is obvious from the conflicting reports of various investigators regarding the value of the roentgen ray in treating the thyroid patient. Repeated small doses stimulate rather than destroy the toxin producing cells of the thyroid and therefore aggravate rather than improve the condition, as shown by symptoms of increased toxicity, and by a still further increase in the metabolic rate. The too massive dose is also to be avoided, because of its profound stimulation to the gland immediately following the exposure, with fatal consequence to the already overdriven heart.

8. Improper dosage, therefore, is to be avoided at both extremes, and this cannot be learned by the individual operator without the aid of some accurate measure of the results obtained in each individual case. The most accurate measure of these results yet discovered is the measure of the metabolic rate.

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DISCUSSION

DR. H. M. JONES (*University of Illinois*): Since the subject of basal metabolism is rather new to most of us, I will begin with a little bit of the elementary part of the subject if you will be patient until we get to the main gist of the argument.

Metabolism may be defined as the sum total of the chemical, physiological processes going on in the body and a measure of that metabolism or of those chemical changes is, or rather a measure of the oxygen consumption of the subject is, a very close measure of the rate of metabolism. It comes about in this way:

The heat eliminated from the human body per unit of square area of, say,

square meter or square foot, is uniform from one individual to another for a given age and sex. It varies with the age and sex, but given the age and sex of an individual, we know just as well what the number of units of heat radiated from that body is as surely as we know the body temperature of the normal person.

Inasmuch as we take the amount of heat eliminated by that body as an expression of the rate of metabolism and also inasmuch as the amount of oxygen consumed is proportional to the amount of heat given off, there is a direct relation between the amount of oxygen taken in and heat given off as there is between the amount of heat in a gram of coal and the amount of oxygen required to consume that gram of coal. It is chemical thermal relation. The measure of the oxygen is a measure of the heat. The measure of the heat is a measure of the rate of metabolism, basal metabolism.

Basal has a significance in this connection. It means that rate of metabolism at which the physiological process, including this consumption of oxygen, is at its lowest level for that individual—not at its lowest level, but at the lowest level for which it is feasible to measure. It is at its lowest measure when the subject is asleep, when he is under complete muscular relaxation, so we eliminate the amount of oxygen he consumes as that energy. When he is completely at mental and physical rest, when the gastro-intestinal tract is empty of digesting food so we get rid of the specific dynamic action of food, the metabolism is at its lowest ebb—that is basal metabolism. It is a uniform rate for the given individual and can be measured from hour to hour so that you can determine the rate of metabolism with reference to a normal scale.

This scale has been worked out by very accurate means and with very costly equipment by Lusk, Benedict, and men working with large, costly equipment, so that we know the number of heat units per calorie liberated by an individual for the body area of one square meter. In men between the ages of twenty and forty, according to one of the standard tables—there are two of them—the number is about thirty-nine or forty calories per hour per square meter.

Benedict has another way of stating rate, per twenty-four hours for the entire individual. There is a discussion as to which is the better method. There is no question but that DeBois' method in which we state calories per hour per square meter is the method that is almost entirely in use throughout the country for clinical work.

The conditions necessary for making a basal metabolism test, that is for determining the rate of oxygen consumption, are that the patient must be lying at complete rest, mentally and physically, and must have abstained from food for the last twelve hours. Those are basal metabolism conditions.

In what condition is the basal metabolism test of use? That is the question every doctor is asking. He wants to know what diseases or what pathological conditions bring about a change in this normal rate. To name those over would be to name some dozen conditions that cause a rise in the rate of metabolism. The commoner ones are any febrile condition, pregnancy, pernicious anemia, hyperthyroidism, hyperpituitarism and a number of others, all of which raise the rate.

On the other hand, there are some half dozen or so which cause a decrease in the rate and then after you explain this, the doctor wants to know why is it since these conditions effect the rate that this test is used practically only in the conditions where you have disturbances of the thyroid gland, either having too much secretion or too little, hyperthyroidism, hypothyroidism, hypopituitarism and hyperpituitarism. Why do we use these?

No one would think of making a test to determine a full term pregnancy or pernicious anemia or a fever. We have other more obvious and easy means of making a diagnosis of those conditions. It resolves itself to this condition, namely: hyperthyroidism, hypothyroidism and similar conditions of the pituitary body. The conditions are so obscure we have no other means of definitely locating or assigning the cause of the condition. Neurasthenia is one of the most common conditions confused with hyperthyroidism, tremor and usually a loss in weight. There are other symptoms that the patient may complain of, as you know, in neurasthenia.

Exophthalmos may be obscured by a family trait. A specific instance: I was called recently to make a test on a patient showing the signs of exophthalmos, tremor, tachycardia, vomiting, weakness and I don't recall the other symptom, and the picture was so clearly hyperthyroid that the doctors on the case were not interested in the diagnosis. They wanted to know "how extreme a hyperthyroid is this? In other words, are we safe in operating?"

The test is not only used to diagnose the conditions, but the severity of the conditions indicated by the degree to which the metabolism digresses from the normal. This patient's rate of metabolism turned out to be perfectly normal. That did not fit in with the clinical

findings. The patient's exophthalmos was traced to a definite family characteristic. Tremor was a nicotine tremor and vomiting was due to food poisoning of two or three days previous. That was definitely revealed in close questioning and every other feature that pertained to the hyperthyroidism not attributed to the neurotic condition explained on other grounds.

This patient, a woman forty years old, had a definite tumor which would direct attention at once to the thyroid. That was a goiter that had been there for twenty years. This diagnosis was cleared up by the little basal metabolism test.

Those conditions are being referred constantly to the physician who has means for making the basal metabolism test. I am safe in saying that the men who refer those conditions for basal metabolism test would not pass up the diagnosis if it were possible to make it, and I am safe, therefore, in saying that with careful technique in running the test, the test in these conditions where the rate is far away from the normal or where it is constantly normal, is the pathognomonic findings with the symptoms of hyperthyroidism. If you have a definite increase in basal metabolism, it is a hyperthyroidism without doubt.

Now, we are interested in the question of whether radiotherapy is effective in treatment of hyperthyroidism. There are not less than fifty men who have had experience proving that definitely to themselves, proving to their own satisfaction with reference to the clinical improvement of the condition, at least. I know of a half dozen men now in the audience who have followed the effects of the treatment by following from time to time the effect on the basal metabolism. Incidentally, as the patient's symptoms improve, as there is clinical improvement, there is tendency for the basal metabolism to return to normal until the normal health is restored and the normal weight observed. The question of whether radiotherapy is useful in the treatment of hyperthyroidism is settled in the minds of many men.

Most surgeons will recommend that there are various surgical measures. Dr. Venaval of the city here would recommend sub-total thyroidectomy any time. Others would not listen to it for taking out so much of a gland would leave the victim subject to hypothyroidism.

I attended a clinic in which seven patients were brought back, out of which only one of them was not in perfect health. He had a sub-total thyroidectomy, basal still fifty per cent above normal. His clinical symptoms

indicated that the condition was hardly improved. Six out of seven under that form of treatment were cured. In a series of cases for Dr. Charles Spencer Williams also of this city, there have been equally good results.

If you choose the cases, no selected cases, Dr. Williamson says that on cases not too far gone, cases under, you might say fifty per cent, and in fairly good physical condition, the x-ray will reduce the condition and the patient will return to normal state of health. Basal metabolism returns to normal within a period of six months to a year without an operation.

Atrill summarizes the advantages of using x-ray for this condition. He lists four advantages. One is that there are no fatalities.

That is the experience of practically every man who gives a large enough dose to be effective and that is the reason many men get no results with x-ray treatment—the doses are not large enough.

Is the case where too much of the gland is rayed or the dose is too strong, the patient will suffer for the next twenty-four hours with an extreme exacerbation of the conditions. Tachycardia is far more pronounced, the temperature goes up and tremor is much more noticeable. All other evidence is manifest. After that the rate gets progressively less and with each treatment after that the condition improves. There is definite improvement. I have seen that happen over the period of the last eighteen months in so many cases that I am positive when I say there is definite improvement with x-ray treatment when the dosage is heavy enough. There is no fatality when the dosage is not too great. No scars and no interference with the patient's occupation.

Many will not permit surgical operation. There is no pain. Those are the advantages.

This paper of Crile's was given in the A. M. A. Journal of October 22. I would rather refer you to one article, if you care to make reference to this article, if you want to know something about the subject of x-ray treatment in hyperthyroidism, I will give you this one reference. That is by Dr. Means in the A. M. A. Journal of July 30. I think there is summarized there in the most rational way the advantages of x-ray with his evidence there and incidentally many other valuable statements with reference to the use of basal metabolism in other conditions. That is the most rational resume of the use of basal metabolism in controlling thyroid treatment as well as the uses of basal metabolism that I know of in the literature of recent date.

There is this question to be settled. Whether it will ever be settled I cannot say. The trouble with giving the x-ray treatment is to know what dosage is required. One gives this amount and another another. One has one way of protecting the gland while raying one-half and the other rays the entire gland. There is no standard method of treatment. The x-ray man is justified in using his own judgment in that respect, as much as the surgeon is in determining how much of the gland he shall remove.

From the standpoint of the surgeon the x-ray method of treating hyperthyroidism is objectionable because he says you never know how much you are destroying of the gland. You leave the patient a victim of hyperthyroidism. Some patients do not react to the treatment. You leave them by such temporizing, subject to the injuries that result to the myocardium by permitting this intoxication to go on. The heart is the victim.

The internist says that the surgeon does not know how much of the gland he should take out, and is, therefore, just as liable to leave the patient a victim to hypothyroidism. These patients are as liable to return to subsequent operation as this hyperplastic tissue regenerates.

It is the experience of all of us to see these hyperthyroid patients returning after a sub-total thyroidectomy. The microscopic evidence of the effect of x-ray treatment is interesting. In fact it gives proof of one of the arguments against x-ray treatment. After x-ray treatment, the connective tissue of the gland is increased. That is shown by microscopic evidence. After the thyroid is rayed several times unsuccessfully, you have to resort to thyroidectomy and the gland is more difficult to remove. That is one of the objections. That is the only objection to x-ray treatment, and I am told by those who have removed thyroids after x-ray treatment that it is not a serious objection at that.

I believe we could summarize by saying that the outlook today as compared to a year ago is definitely in favor of using x-ray therapy in hyperthyroidism. This evidence has been made possible by not only the clinical observations of the patient's condition, but by observing that the rate of metabolism which is abnormal during the condition returns gradually to normal coincident with the improvement of the symptoms. (Applause).

DR. HAROLD SWANBERG (*Quincy, Ill.*): I believe that the basal metabolism test has been one of the greatest boons we have had to the x-ray treatment of hyperthyroidism or the radium treatment of hyperthyroidism. We have

been looking for something to prove our results in a scientific way and the metabolism test certainly is that. Many men have thought this test, referring back to the days when they studied physiology, a very cumbersome and extensive procedure and if those who have not looked into it yet will investigate they will be surprised to find how simple the test is. Any physician with a little application under the guidance of some one who has had some experience in this test, can make the test very well and very accurately. In fact, it is surprising how well these small apparatuses check up with the old typical meter chamber that was so complicated that it could only be manipulated by a metrical expert.

The test is important, not only in diagnosis, but in therapeutic control. The clinical symptoms of hyperthyroidism are such that not any of them are pathognomonic of the condition.

Dr. Van Allen has laid emphasis on the pulse rate. I have seen cases of hyperthyroidism with a slow pulse or a pulse normal or running in sixties. These cases are rare, but it must be remembered that the possibility of a substernal thyroid pressing upon the vagus nerve causing inhibition to the heart is a possible source of explanation of these cases. As I say, they are very rare, but still those are the cases we sometimes fall down upon.

I think that Dr. Warthin's remarks of yesterday should give us new enthusiasm. He has shown that with microscopic examination of the thyroid, if he takes the thyroid and examines it with the microscope, he can tell whether or not that gland has been subject to irradiation. The changes he showed yesterday showed there were mighty marked changes produced.

Dr. Means' work, I think, is very important. If you will notice on these slides, they correspond almost the same as a clinical chart would, that is in the study of pneumonia or typhoid fever. We are accustomed to observe three curves—pulse, respiration and temperature. In thyroid there are also three—pulse, rate and basal metabolism.

In Crile's article we should be very complimentary to think that a surgeon of his type is willing to admit that x-ray treatment will reduce the basal metabolic rate quicker than ligation. He does not admit it with sub-total dissection of the thyroid, but he says that the results by x-ray treatment are quicker in pulling down the basal metabolism than ligation.

I think we owe him a debt of gratitude for the simple apparatus he has enabled us to use. Calculation is practically discarded. By the apparatus he

has invented any one can make a very simple and easy determination.

About the dosage, I feel heretofore we have been giving too light dosage. I have been giving larger dosage than I did early in the work. We do not need to give a dose corresponding to treatment of carcinoma, but we have to give a heavy dose in order to get a good erythema.

DR. PFAHLER: Mr. Chairman, Ladies and Gentlemen: I have been very much interested in this paper. I have treated approximately two hundred of these cases.

I have especially admired the work done in the Massachusetts General Hospital by the combination work, the keen work between the radiologists, the surgeon and the internist, all of whom review each of these cases before they are treated and they see them at intervals.

You have seen the beautiful records that are made, and like one of the previous speakers, I, too, was very much struck with the rather uniform parallelism of the pulse line and the basal metabolism line. Now I believe that this basal metabolism is very important and that wherever practical we should make use of it. I am glad to hear from Dr. Van Allen that this can be done with an hour's rest instead of twelve hours' rest or twenty-four hours' rest in a hospital. I have found that the great majority of the patients I have to deal with object to going to the hospital to have these tests made. I believe that until it is simplified so it can be done in some one's office—not in our own—that we can still go on and treat the great majority of these cases on the basis of the symptoms, a careful study of the symptoms which are known to all of you.

I attach a great deal of importance to the instability of the pulse, that is, the variability in the pulse upon slight exertion. For instance, if you are dealing with a bedfast patient and you count the pulse at rest and without any disturbance on the part of the patient and then set the patient up in bed you will find in this group of patients that the pulse rate will jump two, three or four times, as much as the pulse rate in a normal individual or an individual not suffering from hyperthyroidism.

In the office where the transient patients are I always make two pulse counts, one with the patient at rest—generally sitting or lying quietly on the table—and then with the patient taking a little exercise, such as walking across the room three times. You will find that the rise in pulse rate will be as before, two, three or four times the difference that you would get in another individual.

I think that instability or the variation in the pulse rate under those conditions is of great importance, not only in your diagnosis, but in estimating what you have accomplished by your treatment.

I have repeatedly had patients whose pulse at rest and sitting quietly would be perhaps eighty. When they walk across the floor three times, the pulse would be up to one hundred and twenty. That is too much difference. Your pulse and my pulse would probably vary ten beats under those circumstances. Here we have a variation of forty. When I get that condition, even though the pulse rate is forty, I know that I cannot stop treatment on that patient. Of course, we are ruling out organic heart disease or those conditions that would definitely give you pulse rise on slight exertion.

I believe, if you make this double check you can tell whether you are counting your pulse under excitement or not. For instance, I walk into the room in which the patient is sitting and take the pulse rate or some one else does it. My coming into the room may excite that patient and the pulse rate may be high. If you put that patient through a little exertion, I find it does not go up any higher. Therefore, I know that that pulse rate is already examined under excitement.

Then we let the patient have the treatment, perhaps after lying quietly on the treatment table for a time. We count the pulse rate again and find instead of going up it has dropped down to perhaps eighty, eighty-five or ninety. I do not try to treat these patients until the pulse rate returns to normal, say seventy-two in a sitting position. I think we should stop before it comes to normal because we get a delayed effect in these cases. If we watch that carefully, increase the interval between our final or late treatments, we will avoid any hypothyroidism.

The surgeons' argument that we may produce hypothyroidism is one of the best arguments we have. If we can produce hypothyroidism, we can cure the patients. He must admit it. We are reducing the secretion as he is by cutting out certain parts of the gland. We have from six to twelve guesses to make where he has one. Certainly our average ought to be better than his. (Applause).

DR. LEE C. GRABER (Cleveland, Ohio): There seems to be a very widespread notion that the estimation of basal metabolism by any one other than an expert is a very difficult thing to do. This is a misapprehension, partly justified by the fact that for many years or for a long time, the estimation of basal metabolism could only be done

by extensive, complicated apparatus, likely to become out of order and it had to be done in well equipped laboratories presided over by expert technicians.

Just last June I had the good fortune of doing post graduate work in Doctor Gabbard's clinic at Boston. I heard Doctor Means. I went over to the laboratory and found the apparatus out of order. The technician was very much fussed up and all in all the situation was one that would lead one to believe that it was impractical and could not be done by other than an expert. That was true last June, but we are in a world that is moving pretty fast, and it is not true now.

There is an apparatus now you can use nicely in your own office. The procedure is simple and can be done with any one with average training.

Somebody asked for the name of the instrument.

—If I will not be accused of boosting somebody's financial game I will give the name. It is the Sandborn Handy Apparatus and is on exhibition in the hallway. I use it and I find it exceedingly satisfactory. I have my patients come to the office by appointment in the morning. I tell the patients not to eat anything after seven o'clock in the evening and not to drink anything after four o'clock in the morning and come to my office for an early eight o'clock appointment.

The patient comes and I have him lie on the couch in the office quietly for half an hour, during which time I can do other work, attend to mail and things of that sort. Then the estimation is made and the patient goes home. That is all there is to it. It is a simple thing to do and is very satisfactory. That is the main reason for my speaking now.

DR. DARLING (New York): The treatment of hyperthyroidism, it seems to me, has about reached the stage where it will come into the hands of the roentgenologist or the radiologist. The points that I wish to inquire about rather than to try to tell about—because I have had a rather limited experience, but I expect to have a greater experience—are these: The possibility of hypothyroidism is not to be forgotten and no one wishes to condemn a patient to the possibility of a thyroid tablet every so often for the balance of his life.

It seems to me that we have a chance to nicely balance our therapy. For instance, we know that we can destroy and stimulate these secreting glands. If we can do that, we must be careful not to stimulate when we should destroy.

If we can destroy, we should be very careful to destroy the amount that the patient could stand at each session, so I am going to advance this query—perhaps it has been done before: Suppose we divide the thyroid into four quarters. I believe it is possible to do this roughly, of course. We will save one quarter and keep one quarter sacred until the last moment, in the case of a sheet anchor to save us from hypothyroidism. Then we will take the other quarters and give the destructive dose to each one of these and follow the matter closely with our basal metabolism or the close rate as is indicated in the particular instance, and that way nicely control our treatment and follow along and in the end we will be conservative. You will not bring about a precipitant cure, of course, but you may be doing the patient a greater benefit.

DR. LAWRENCE: I simply want to add a voice of some experience in this matter. I have treated a great many cases of hyperthyroidism over the last ten years. It is work I have always enjoyed because of the fact that we get such definite results.

I think there is not quite a unanimity of opinion among the x-ray men even, therefore, I think the experience of all of us has some value.

In speaking of the instability of the pulse, I have had one patient, certainly, and possibly two others, that have had this type of variation in pulse. The pulse would run along one hundred and twenty standing or sitting, possibly a little less. The moment the patient lies down it drops to below normal, as low as from forty to seventy, repeatedly. On one patient I tested that out repeatedly and it was below normal and would remain that way a little while and then pick up to the normal rate. I would like to ask if any one else has noticed that variation of pulse rate? When I was using good sized doses I noticed this.

Two years ago somebody advocated milder doses. I tried it out and did not get results. I think that since the dose to be used has to be large, we should use adequate filtration and remember that we are after results. Somebody said we could get results with no scar. We may with large doses that continually have to be repeated. We may get the characteristic x-ray skin if we are not careful not to get them too large. That is where it is noticeable, around the throat, and we must be careful on that point.

DR. SANDERSON (*Iron Mountain*): So much has been said about Dr. Crile. It surprises me he has changed his views on the value of x-ray. I doubt

it. I know that Dr. Crile a year ago doubted the value of basal metabolism. The tests he uses have not been referred to—the so-called Goetsch, which consists of injecting six drops of adrenalin subcutaneously, injecting it into the deltoid muscle, taking the pulse two minutes after the injection with the patient lying down and taking the blood pressure at the same time, before and after injection. In five minutes time the pulse and blood pressure should return practically back to the normal. If there is a variation of ten or more degrees, you have a condition of hyperthyroidism. It is the test I followed in all of my cases.

The other pulse relation is something we followed in the army called the efferent syndrome, and was the cause of shell shock over in France, which is nothing more than a nervous phenomenon.

DR. JONES: I am glad to have this opportunity to quote my authority for the statement that I made. If I conveyed the impression that I understood that Crile had preferred x-ray treatment to surgery I certainly said something I did not mean to say in the first place. If I said that I misquoted my own idea of it.

I have here *The Journal of Radiology*, the December number. I will read you what Dr. Crile says. This is an abstract from an article by Dr. Crile, A. M. A. Journal, October 22. I did not read the original article. I do not know how I overlooked it because I am interested in that subject. I always scan through the front page of the A. M. A. to find what is there on anything in connection with that work. This article is quoted as being in the A. M. A. Journal.

Dr. Jones read the quotation referred to.

I know Dr. Crile's objection to the basal metabolism test. If he still uses the Goetsch test (if I am permitted to start that again)—the Goetsch test was shown by three men, I cannot give you the names, but in the *Journal of American Medical Science* of last February, or January, they tried out the value of the Goetsch test. They found it to be a test valuable in detecting numerous sorts of vasomotor instability—not specific to hyperthyroidism by a long ways.

Some one asked me to speak a little more in detail with reference to hyperpituitarism. It produces a condition called gigantism, which is familiar to all of you. Coming on in the adolescent period. I meant to say acromegaly, coming in the adolescent stage produces gigantism.

Cushing has done most of the work in surgery of the pituitary. I cannot give any of his statistics. His surgical technique, as you know, must be something very refined. I do not know of any one else but Cushing doing that work. He does get results in surgery of the pituitary body. In hyperpituitary there is a condition called eunuchoidism, a condition described by some German writers in which there is an inherent arrest of the sexual apparatus, seen practically only in males, I believe. A boy of the age of eight or ten will show this condition called dystrophia genitalis or Froehlich's syndrome. There is a distinction to be made between the two types of Froehlich's syndrome that due to hyperpituitarism and to the so-called eunuchoidism.

Removing the testicles will, in a boy of five, cause conditions you see in a boy eight or ten. You see a failure of the genitals to develop. A positive fat over the region of the genitals, buttocks covered with fat and rounded appearance of the face, more of the effeminate development.

In both conditions the basal metabolism in the hyperpituitary form of this condition is subnormal. The basal metabolism in the eunuchoid form is as normal as in any boy of the same age. The basal metabolism serves to distinguish between the two. There are other less definite methods of differentiation. In the hyperpituitary condition the patient is under size and in the eunuchoid form the patient is taller than normal.

Dr. Van Allen said this test was easy. The test for basal metabolism is not difficult. It is a plodding test, to a certainty. It must take your entire attention for the time while it is being done. It is not difficult, the apparatus is not expensive, and it is a thing that many of us would like to take up. I do not suppose that we will all do this work. This is the reason that I brought out the fact that the pulse could be a guide in many, many cases; perhaps not in all, so if you are sending your case to the laboratory for a test you do not have to send them except to get your diagnosis in the first place, afterwards to see if you are really successful.

Dr. Swanberg spoke about an erythema. I do not believe an erythema is to be looked upon as a good thing to have in these cases. I believe you get an atelectasis after several years if you have an erythema. I do not believe an erythema is to be looked upon as a good thing. My cases get a sort of brown, not an erythema. That is the reason for the fractional dose that I recommend.

X-Ray Studies of Mediastinal Shadows with Special Reference to Dermoid Cyst*

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OF the many conditions found roentgenologically in the mediastinum, neoplasm, either primary or metastatic, is not frequent. Aneurysm of the arch of the aorta is quite common and may be mistaken for a neoplasm. Other shadows may be due to Hodgkin's disease, enlarged thymus, substernal thyroid, abscesses, echinococcus cyst and demoid cyst. Fibromata, chondromata and lipomata (benign neoplasms) have rarely been found, and although they may occur, they have not been demonstrated roentgenologically so far as I am aware.

Of the malignant neoplasms, sarcoma is more common than carcinoma. Sarcoma is usually primary in the form of lymphosarcoma. Lymphosarcoma, however may be secondary. Sarcomatous shadows vary in size and contour and those due to metastases often appear rounded and circumscribed. These may be small or very large, and usually multiple. Lymphosarcoma usually manifests itself as a large single shadow and may occupy the greater part of the chest. Metastasis frequently follows malignant sarcoma of bone and may also follow sarcoma of the tonsils, cervical lymph nodes, the breast, or other regions of the body.

Primary carcinoma of the mediastinum arises from the mucous membrane of either the esophagus or trachea and rarely from the remains of the thymus

gland. It may occupy either the right or left side of the mediastinum or may occupy both sides.

It is not, as a rule, confined to the mediastinum alone and not infrequently involves the lung and pleura as well. Carcinoma of the breast not infrequently metastasizes to the mediastinum although metastases may also be due to carcinoma elsewhere in the body. It is difficult to absolutely differentiate roentgenologically between primary and metastatic carcinoma; however, the clinical history may help to decide. The shadows in primary carcinoma are usually irregular in outline and often invade the lung and pleura. Shadows due to metastatic carcinoma are usually more regular in outline and are apt to be limited more to the region of the mediastinum, although invasion of the lungs is not infrequent. In neither the primary nor the metastatic carcinoma have we seen calcified shadows.

Aneurysm of the arch of the aorta may be mistaken for neoplasm. It may be differentiated from neoplasm more quickly and probably better by the roentgenoscope than by any other method, through observation of the expansile pulsation. One must be careful, however, and not mistake a normal pulsation, transmitted to an adjacent neoplasm, for an aneurysm. Roentgenographically the periphery of an aneurysm has a somewhat wavy appearance, as its borders are not sharply defined, due to pulsation. In neoplasm simulating aneurysm the periphery is usually well defined.

Hodgkin's disease, roentgenologically, resembles somewhat lymphosarcoma; indeed, the mediastinal shadows of these two diseases cannot be absolutely differentiated. In the former the shadows probably are not as large as in the latter. Hodgkin's disease as a rule makes its first appearance in the neck and later involves other regions. The mediastinal involvement is usually a later manifestation of this disease.

Enlarged thymus is occasionally manifested by a shadow occupying the anterior mediastinum. A history of difficult breathing, substernal dullness with pressure symptoms, especially in infants or young children, should arouse suspicion of enlarged thymus.

Abscess in the region of the mediastinum not infrequently is due to an extension of an inflammatory process from the lung and pleura. It may also follow infectious processes of the ribs, sternum or cellular tissue of the neck. Occasionally an amebic abscess involving the lung extends to the mediastinum. Roentgenologically a mediastinal abscess usually has a sharply defined border. It may be fairly large. No pulsation is visible roentgenologically. The shadows are not quite as dense as those due to neoplasm.

Echinococcus cyst, which is very rare, occasionally involves the mediastinum. Its common site is the right side in the region of the base. It may be attached to the diaphragm and not in-



Figure I.—Large tumor shadow occupying the right and left mediastinum and half of right and left upper lobes, due to metastatic lymphosarcoma. Patient had lymphosarcoma of the tonsil five months previous which was operated and removed.



Figure II.—Marked infiltration of both apices and upper lobes, in all probability metastatic lymphosarcoma. The infiltration appears well organized and regular. Patient has lymphosarcoma arising from the wall of the pharynx.



Figure III.—Large rounded circumscribed tumor shadow occupying right apex and upper lobe. There are also smaller rounded circumscribed shadows in the right and left lower lobes. Patient had amputation of the femur three years previous for periorbital sarcoma. The circumscribed rounded tumor shadows are quite characteristic of metastatic sarcoma.

*Read at mid-year meeting of the Radiological Society of North America, Boston, June 3 and 4, 1921.

frequently is an extension upward from the liver.

Dermoid cysts arise in the mediastinum and vary in size from that of a walnut to that of a child's head. The small tumors remain in the mediastinum while the large ones may extend outward into the pleural cavity. A few have been described occupying the right base. In shape they are usually spherical, but may be flattened when in contact with the diaphragm. The cyst wall may be very thin or quite thick, and is invariably adherent to surrounding structures, most commonly to the pleura. Partial calcification of the cyst wall has occurred in a number of cases. Cholesterol crystals are a common finding, and in the majority of cases the cyst also contains hair, epidermis, cartilage, bone, teeth, etc.

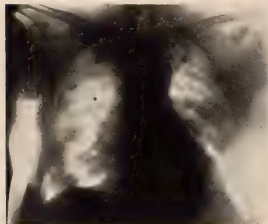


Figure IV.—Metastatic sarcoma of mediastinum and lungs twenty months after operation for sarcoma of the breast. The shadows are well defined spherical and dense, quite characteristic of metastatic sarcoma.



Figure V.—Primary carcinoma of the lung. The infiltration involves the right hilum and upper lobe.

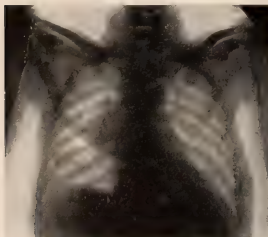


Figure VI.—Metastatic carcinoma right mediastinum and lung eighteen months after operation for breast carcinoma.

Heuer of Johns Hopkins, who reviewed the literature of dermoid cyst of the mediastinum, stated that Roger Morris collected a series of fifty-seven cases in 1905; Dangschat collected a series of forty-four cases in 1903; and Pohl collected a series of fifty-two cases in 1914. Very recently Hertzler reported a case of dermoid cyst of the mediastinum in his Clinical Surgery.

Our case is one of a white female, age 14 years. Admitted to Saint Agnes' Hospital December 12, 1920.

Family History—Unimportant. Parents living and well. Uncle on father's side died of cancer, otherwise negative.

Past History—Had measles, whooping cough and scarlet fever. Subject to frequent colds. Tonsilitis several times. Otherwise negative.

Present Illness—About four weeks ago, without any history of trauma, patient noticed a dull aching pain at upper end of sternum. At about the same time she noticed a slight bulging over this area. Since that time the right chest has bulged and tumor has grown to the size of a peach. Pain has disappeared entirely. No other symptoms noticed except a lump. About a week ago patient developed a cough with coryza and general malaise. This has grown worse in the last few days. Dr. Bloodgood has had patient under observation for the past two weeks. He referred her to Dr. Kelly for radium treatment and patient has received seven treatments. Mother thinks the tumor has grown smaller and softer since treatments.

Physical Examination—Patient is a well nourished child of about fourteen years, complaining of a slight cough. Perfectly oriented in all spheres. No dyspnea, edema, jaundice. Skin is darkly pigmented, otherwise clear. Veins of left side of face and neck most prominent. The head is negative. The mouth and naso-pharynx are negative excepting that the tonsils are greatly enlarged and almost meet.

Thorax—Asymmetrical, the right chest apparently bulging slightly. In midline is seen a semispherical tumor about the size of a peach at the upper end of the sternum. This is soft and attached to the bone with a definite edge. The heart sounds are normal. On percussion there is a flatness from about the third rib on the right side out almost to axillary line. This cannot be separated from the liver dullness. Percussion on the left is normal except that the retromammary dullness is greatly increased. Many mucous rales can be heard at the right apex and hilum, and at times a definite friction fremitus is heard to the right of the upper portion of the sternum.

Abdomen—Liver two fingers below costal margin, otherwise negative.

Extremities—Negative.

Blood—3,660,000 red blood corpuscles, 6,600 white blood corpuscles, hemoglobin, 68 per cent.

Urine—Negative except for a slight trace of albumin.

Roentgenoscopically there is a large rounded tumor shadow occupying the greater part of the lower two thirds of the right side of the chest. On deep inspiration this shadow moves freely and reveals lung structure posteriorly and below. The liver shadow appears somewhat depressed. It apparently is slightly attached to the diaphragm near the median line. No pulsation can be seen in this region. The upper right lobe and apex appear clear. The left lung is clear. The heart shadow is



Figure VII.—Extensive infiltration of both lungs due to metastatic carcinoma. Patient has carcinoma of the sigmoid and rectum.

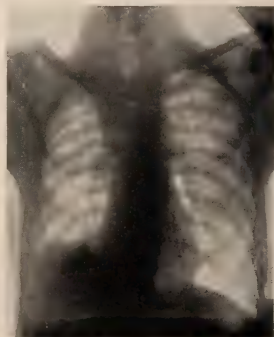


Figure VIII.—Dense fibrous infiltration of right apex and upper lobe extending downward toward the hilum. Infiltration simulates neoplasm, but is in all probability healed fibrous tuberculosis. Patient gives a definite history of tuberculosis.

displaced well to the left, probably the result of pressure by this tumor. The heart appears slightly enlarged. There is marked gradual curving of the dorsal spine backward. Stereoscopic roentgenograms and lateral roentgenograms of the chest confirm the above findings.

Impression—From the history and the above findings this tumor shadow is probably due to a large dermoid cyst. However, an echinococcus cyst is to be considered.

Operation—December 23, 1920, by Dr. Bloodgood. His notes of the operative findings are as follows: Novocaine. Incision made over swelling over sternum. This proved to be a cavity filled with thick yellow pus and granular debris, but on opening, adhesions of this cavity to chest could not be found. Incision then made below breast, nipple line, and rib removed. We then encountered, after dividing parietal pleura, a cyst. On opening it was found to be four mm. thick and to contain same material as cavity over the sternum, also hair. This made the diagnosis a dermoid cyst. Cover slips from piece showed no bacteria, no leukocytes.

Frozen section (of wall) showed fibrous tissue, no evidence of tuberculosis. Epithelial lining not seen.

The cyst rested upon the diaphragm below, to which it was slightly adherent, but from which it could be easily separated. To the outer side and above was the lung, with very few adhesions. This portion of the cyst could be separated, but the larger portion under the mediastinum could not be separated from the pericardium and further attempt at enucleation produced falling of blood pressure and rapid pulse. When this manipulation ceased, blood pressure rose and pulse improved. A

Brewer tube was sutured into the cyst and three pieces of long gauze, wet in salt, were packed in between the cyst and surrounding tissue.

Post Operative Course—Immediately after operation there was increased rate of respiration. Patient had very acute thirst and drank about two or more liters of water each twenty-four hours. The urine output ranged from three hundred to six hundred cc. in twenty-four hours. Before operation the urine was negative for casts with only a slight trace of albumin. It now showed plus one albumin and many casts. The temperature ranged between one hundred and three and one hundred and four.

For three days after the operation the pulse ranged between one hundred and forty and one hundred and sixty. The respiration averaged about fifty. There was rather free drainage around the tube. The amount of drainage through the tube was considerably less, being about two hundred cc. a day.



Figure X.—Large mediastinal tumor occupying greater part of right side of chest. Stereoscopically the tumor appeared more or less rounded in contour. Found five years after empyema. Exact nature of tumor not determined.



Figure IX.—Large fusiform aneurysm. Marked expansile pulsation noted roentgenoscopically.

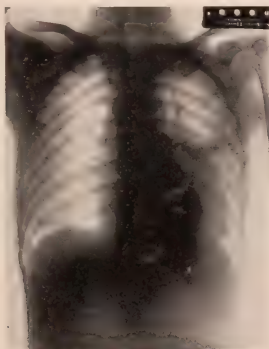


Figure XI.—Localized and well defined shadow in the region of the left hilum, mediastinum and part of the lower lobe, following pneumonia. In all probability walled off abscess.

Examination of lungs showed pneumonia of right lung.

The night of the second day after operation, because of the decreased output of urine, patient was given magnesium sulphate and the bowels moved seven times during the night. The next morning the patient appeared very much better. The respiration had decreased to forty, and the pulse to one hundred and forty and the temperature to one hundred and three. The pneumonia of the right lobe seemed to be clearing up. There was very little cyanosis. During the afternoon patient's pulse, respiration and temperature rose suddenly, the respirations reaching sixty and the pulse one hundred and eighty and very weak. The patient became very cyanotic and died in about an hour after the sudden change was noticed.

Necropsy by Dr. W. C. Caldwell—His notes are as follows: The Brewer tube and the drains were removed. On introducing the hand into the cavity through the incision, it was found that the large cyst had occupied practically the entire space of the right lung, the right lung being pushed up into a small space in the region of the clavicle and apex. The cyst extended from the mediastinum to the liver, to the chest wall, and almost to the clavicle. There was a definite pneumothorax as the cyst had decreased somewhat in size, since drainage. On attempting to detach the cyst, it was found to be very adherent above, in the region of the clavicle, but particularly in the mediastinum, where it was so firmly attached that one was unable to separate it with the gloved hand. On opening the cyst it was found to contain a tumor mass about the size of an orange attached at the upper portion of the cyst. This tumor mass was removed. It was impossible to remove the cyst wall intact,



Figure XII.—Three weeks later, spontaneous rupture into bronchus with disappearance of shadow.

but a portion of the cyst wall was removed for examination. Examination of the small compressed lung showed what was apparently red hepatization. A block of this was removed for examination. There was now a cavity in the position formerly occupied by the right lung as large as a child's head.

Gross Pathology.—The tumor mass which was irregular in outline, was soft and spongy in consistency, had a pinkish white appearance and looked very much like skin. It was covered with short fine hair. On section, the skin surface had a thin layer of connective tissue beneath, very similar to normal skin. Deeper down there was considerable fat and a connective tissue stroma. Piece of the cyst wall showed a very dense hard fibrous tissue almost like cartilage. Piece of lung showed consolidation.



Figure XIII.—Dermoid cyst occupying greater part of the right side of the chest. This tumor is somewhat spherical and there is no expansile pulsation roentgenoscopically. The possibility of echinococcus cyst was considered because of its size. Cyst markedly adherent to the mediastinum and sternum so that it could not be completely removed.



Figure XIV.—Gross specimen of dermoid cyst, showing its skin-like covering and numerous hairs.

Microscopic Study.—Section of the cyst wall was very similar to that described immediately after the operation. It was composed of very dense fibrous tissue and there was no evidence of an epithelial lining. No hair follicles, no sebaceous glands, no sweat glands.

Section of the tumor showed an epithelial covering very much like skin. There were hair follicles, sebaceous glands, and sweat glands. Beneath the epithelium there was subcutaneous connective tissue and fat.

Section of the lung showed a chronic fibrosis with later chronic inflammatory tissue and fresh pneumonia in the stage of red hepatization.

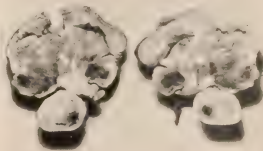


Figure XV.—Section through cyst.

From gross and microscopic findings it seems that the dermoid tumor with a pus material was inclosed in a fine fibrous cyst which probably represents a reaction of the body in walling off the original dermoid tumor.

Final Diagnosis.—Huge dermoid cyst of right lung, firmly attached to the mediastinum.

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DISCUSSION

DR. J. C. BLOODGOOD, *Baltimore*: I do not know what I can add in the discussion, but all of us must realize that due to the x-ray we have revealed the fact that the mediastinum is much more commonly involved than we have ever thought, even in primary lesions and in secondary lesions.

One of the most interesting observations I can speak of, which has not been mentioned, is the therapeutic dose of radium. If you have a mediastinal shadow, irrespective of the history, give intense radiation and there will be, in the great majority of cases, a reduction in the shadow. That means sarcoma. I have never seen after radiation a mediastinal tumor that I felt was carci-

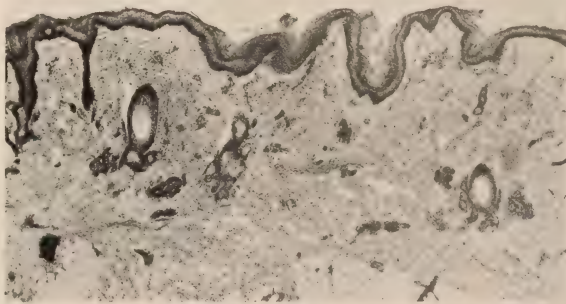


Figure XVI.—Photomicrograph of section of tumor reveals a definite layer of skin with hair follicles, sebaceous glands and sweat glands. Beneath the epithelium there is subcutaneous connective tissue and fat.

noma primary or secondary which showed any change whatever. In the little girl reported by Dr. Kahn, in which the huge size of the mediastinal tumor suggested a dermoid cyst there was no improvement whatever after radium. I felt it was unquestionably a carcinoma.

I do not for a moment feel that any of the sarcomata have been permanently cured by radium, but in all those we have been able to follow the sarcoma has grown very much smaller under radium. Of course, we can check a great number. There are primary tonsils and we take out the tonsils, or there are primary glands and we take out the glands and they show sarcoma cells. X-ray of the mediastinum is becoming a very important part of complete diagnosis. Unfortunately, we have not many autopsies.

The thing I am most interested in just now is the relation of mediastinal involvement in cancer of the breast. In the first place, here is a woman who has been operated on for cancer of the breast. She has some shortness of breath, some rheumatic pains, most of these patients are at the age where shortness of breath comes on irrespective of any malignant disease. Can you differentiate the shadows of cancer or malignant disease from some of the shadows we see in routine examination? If you take x-rays routinely of all your patients, you will see mediastinal shadows that are very difficult to differentiate. The reason I am calling attention to this point is that there seems to be a good many cases reported of mediastinal metastases after cancer of the breast. I think Dr. Kahn will agree

with me that of all cases of carcinoma of the breast in which the mediastinal shadow is of sufficient size to justify diagnosis, we have seen no improvement in the shadow nor are any of the cases permanently cured. I think perhaps some of the improvements are due to incorrect diagnosis of the mediastinal shadow. I think there is a great opportunity for all of us to attempt to keep most accurate records, especially of shadows in the mediastinum, so that when a patient with cancer of the breast comes up for routine examination with a shadow in the mediastinum we can watch that shadow. I do not know how many of you make the diagnosis of mediastinitis, but I would like to offer a prize to any one who has proved the diagnosis at autopsy.

Of course, with this little girl it was a great disappointment to fail to cure a perfectly benign tumor. Looking back, I think one mistake we made was to operate too quickly after radiation. This child had had intense radiation and then returned. The x-ray shadow was negative and we gave a second radiation. I feel now from my experience that that second radiation was unnecessary and that if radium was going to help that child it would have shown in two or three weeks. The failure to get a reduction in the shadow showed we were not dealing with a lesion that was amenable to radium. Some of my colleagues tell me that operation should not be performed too quickly after radiation. The radiation seems to lower the vitality of the tissues. One doctor tells me of a hysterectomy performed a week after radiation and the patient died of a streptococcal infection.

This little girl was operated shortly after radiation. Remember, this child had had no pressure symptoms and she had no trouble until the swelling appeared over the sternum. When I saw the shadow in the mediastinum and the swelling over the sternum, the probable diagnosis to me was tuberculosis. When I opened the swelling it looked like tuberculosis. I think that was a mistake. The question is, was it a mistake in operating and trying to remove that tumor. Some of you have not my record of thirty years of surgery. I have looked it over. I have had a very large experience in draining large cysts in the abdomen, especially pancreatic cysts. Whatever the technique, there is danger of secondary infection. All of those cases are infected, some of them die. I feel that when I decided to operate on this girl drainage was contra-indicated. I think Dr. Stewart showed that the drainage mortality was high. We did the operation under novocaine and the child was in good condition. We resected the rib and then with one hand we separated the cyst from the diaphragm and with the other hand we separated the cyst from the lung and it looked to me as though we would be successful. The mistake made was opening it. I should not have opened it. I thought by opening it I could reduce its size. Having opened it, I had to drain afterwards. I should have attempted to remove it without opening it. Having decided not to remove it, I should have left it alone and closed the chest wall. I think the child would be living today if I had not opened it. It was the opening and draining of the cyst that caused her death.

Explanatory Note:—Dr. Kahn's article was pried in the February issue and is here printed, corrected, with our apology.



EDITORIAL

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The Torch of Aesculapius

I.

ANYTHING like a definitive effort to understand the relations of science to health for the purpose of developing an intelligent science of health requires a critical survey of history for the purpose of determining wherein science has failed, why it has failed, and what its real relation is to obvious social maladjustments. How briefly this can be done depends entirely on the ability of the person attempting it to discriminate between those incidents which have had a direct bearing on the trend of scientific development, and those which have not.

In what follows, if statements here and there seem cryptic or cramped it is because of an earnest desire to observe the natural limitations of time and space and because of a sincere regard for reader patience.

It seems wise, also, at the outset to say that the sole purpose of the allusions to religious institutions and scientific performances is to set up the essential historical facts which establish accurately the trend of all science in relation to the composite social welfare.

No thought of secular or religious controversy has any part in this discussion. The church is only mentioned because it was in the first instance, so far as records are discoverable, the preceptor of all science. And in order to draw off sound deductions concerning the social problem as it exists today, one must be fair enough to review the record as it stands, admit social and scientific failure when it obviously exists, and use those mistakes as the stepping stones to ultimate success, no matter if the facts hurt petty personal pride and give the lie to innate prejudices that have been built up in a million different silly ways.

II.

With this sort of a mental attitude only is it safe and profitable to dissect the corpse of the social body. Much of the history that is available must be first stripped of its local color before it can be viewed in its correct relation to the social trend.

Keeping these thoughts in mind constantly, the plunge is taken.

As early as 4000 B. C. history affords abundance of evidence that science, and especially that amalgamation of all science known as the science of medicine, was practiced quite universally among the Greeks and Egyptians. Indeed,

there has always existed in the human being, and possibly in many of the lower animals for aught man knows, a feeling called sympathy, which has been the dominating motive in every case of great physical and mental distress. From that feeling, it is but the natural sequence of things for man to attempt methods of relief, and when those methods have been proven efficacious in a sufficient number of cases, they at once become the priceless treasure in the storehouse of knowledge to be preserved and used in circumstances of extremity and human suffering.

Life has always been shrouded in mystery. It has been associated with all sorts of Gods—each generation has evolved for itself certain new ideas or revived certain old theories—every century has struggled to unravel the mystery and has fallen back to a blind acceptance of the thing called life as an inevitable sublimation of a supernatural power.

This was the underlying principle which brought about the practice of trephining the skull. The early Greeks and Egyptians believed that headaches were caused by the confinement of evil spirits in the skull. Carrying that belief into execution led to the boring of holes that the evil spirits might escape, and according to the available records some patients submitted to the operation as many as twelve times.

Running through the record hurriedly, each new century developed numerous other ministrations designed to ameliorate human suffering. Medical practice, or the application of medical science to the human family, in its early stages was a function of the priesthood. As an inevitable consequence, since religion in those days dominated all political and economic and social relations, it is no cause for surprise that the priesthood sought to add another prop to its topheavy structure by claiming an uncanny and supernatural power and by shrouding their most commonplace achievements in weird incantations designed to produce an ebullient religious fervor.

Up to 410 A. D., a lapse of nearly 4,500 years, science gradually added to the sum total of human intelligence, so that it then occupied an important place in public opinion. Much thought and study had been given to it, and the church suddenly found itself in the anomalous and painful predicament of having fostered and incited a realm of thought which far outstripped the progress of intellectuality in the application of religious principles to every day life.

In the beginning of the Fifth Century it became apparent to the church that science was fascinating men because it dealt with facts, because it was able to take effects and trace out causes, because it could take causes and predict effects. The result was an increasing disinclination on the part of the rank and file of the people to accept blindly and without question all of the fatuous dogmas, ceremonial rites, financial tributes, and ignorant mysticisms which at that time formed so large a part in the church ritual.

The reaction was inevitable. Science, a child of the church, was declared as altogether too precocious by those men from whose loins it sprung. The church thought its stability and social dominance threatened. And science was accordingly sought to be smothered by its own flesh and blood. Such men as Copernicus were burned at the stake for their scientific utterances. Science was held abhorrent. The people were repeatedly admonished in no uncertain language that the only thing in life which mattered was that knowledge which made men "wise unto salvation." The peculiar power of the mystic was invoked with such

persistence that the people believed, and turned its back completely on the rational facts of human conduct. All the intellectual attainments and scientific achievements heaped upon the shrine of a toiling, moiling, and suffering humanity by the Athenians and Alexandrians were deliberately cast aside. And the iron heel of the church crunched down on the sensitive neck of the intellectual and scientific body. The priesthood exhibited a sort of unctuous virtue in its abandonment of truth for purely theoretical teaching. Even St. Paul, the Apostle, found it necessary or expedient to justify his mystic utterances occasionally, as is demonstrated by his own words that "all things count for dung but to win Christ."

III.

Mediaeval history chronicles no scientific advance. The works of Aristotle in logic, in metaphysics, in rhetoric, in psychology, in ethics, in poetry and natural history, in comparative anatomy, in systematic zoology, in embryology, in teratology, in botany and physiology; the valuable findings of Hippocrates, of Pliny, the anatomist, of Praxagoras, the clinician, of Galen, physician to Marcus Aurelius, and one of the great anatomists and physiologists of history, were deliberately destroyed.

But thanks to that indestructible bond of human sympathy, a few devotees of science risked their lives by hiding out in caves and cloisters such of the records of scientific achievements as they were able to lay hold of in the turmoil and zealous infliction of religious intolerance.

In the Thirteenth Century the orgasm of religious frenzy had subsided sufficiently that a few courageous students of the rudiments of life again picked up the golden thread which is woven out of that shimmering texture which runs through precise knowledge concerning man's mortal habilliments.

Since then, the realm of science has been in the ascendency. Though slowly, it has surely grown day by day in public confidence and opinion, and science now stands in the affairs of the world as the equal, if not the actual peer, of all social resources. Archaeological pursuits have been so extensively carried out that the accumulated knowledge of the centuries has been made available to all men for all time, and a new era is opening out, an era in which science will again pick up its constructive labors that the social nexus may be brought to an equilibrium and an understanding of some of life's obligations become the common property of humankind everywhere.

IV.

For those desiring to familiarize themselves with the historical details of scientific development, attention is called to the lectures of the late Sir William Osler, delivered at Yale University in April, 1913, on the Silliman Foundation, and lately published in book form by the Yale University Press under the title, "The Evolution of Modern Medicine." There were six of these lectures dealing with the first beginnings of science, Greek Medicine, Mediaeval Medicine, The Renaissance and the Rise of Anatomy and Physiology, The Rise and Development of Modern Medicine, and The Rise of Preventive Medicine. Each lecture constitutes a chapter, and the whole is profusely illustrated by reproduction of some of the records of the outstanding scientific achievements on which the author builds his history.

While it may be contended that these lectures were prepared by a medical man for medical men, and should not, therefore, be accepted as true indices of the scientific trend, yet they go so deeply, exhaustively and authoritatively into the progress of all phases of science, from the historical standpoint, this sort of a summary disposition of the book cannot be well taken. They constitute what is undoubtedly the latest authentic historical sketch of science and are ex-

ceedingly interesting for any person anxious to know the exact facts about scientific development.

More than this, however, no thinking man, can read these lectures through critically without being impressed with the thought that the shibboleth of the medical profession, "To ameliorate human suffering and to prolong human life," is, in the last analysis, the mother of all scientific endeavor, and that because the science of medicine was conceived in human sympathy and understanding, it now carries a tremendous responsibility in connection with the disentanglement processes of the complex social organism.

V.

The serious student will also be fascinated by the indisputable fact that during all of the centuries for which there are available authentic data concerning man's conduct, science has kept burning the only beacon light which has offered any substantial hope for the achievement of some plan whose radiant energies may be made to illumine the path leading out of social chaos.

Quite true. The records show that sometimes this beacon light burned brightly and in full flame, sometimes feebly and all but flickering out, but there have always been on hand some ardent souls who refused to see it extinguished forever.

And no man can read intelligently of the ups and downs of science through the ages without being impressed with the feeling that The Torch of Aesculapius has always produced its beneficent reflections in the composite social welfare in exact proportion to the esteem accorded medical science by public opinion. There is an abundance of irrefragable evidence to show that the social well-being has been good, bad, or indifferent in precise ratio to the length of the shadows falling across the path of the standard bearers of medical science.

VI.

It would hardly be sensible, however, or within the precepts of true science, to pass from this premise to a conclusion without giving due consideration to three facts:

- (1) Notwithstanding its precepts, the votaries of science have not accorded that degree of thought and effort to the constitution of an inclusive, cohesive, and synchronized social philosophy which the present welter so unmistakably demands.
- (2) There has not been, either on the part of scientific agencies or the public, proper recognition of the fact that medical science touches, and more nearly understands, all phases of human conduct, and should for that reason be better able to act as the expressive agency of the social welfare in all matters involving human life and happiness, whether they be dubbed politics, economics, or religion; and
- (3) The devotees of medical science have not sufficiently studied, comprehended, and acted in the larger spheres of human relations, because they have not observed with understanding those travails incident to the birth of a new social child requiring a wholly different conception of the functions of medical science as a social unit.

VII.

This is a startling indictment of all scientific men. It is also an indictment which should set the medical profession by the ears. But when writers on sociological and quasi-scientific subjects by the score plead for the socialization of all scientific endeavor, as this term is generally understood, and especially point an accusing finger at medical science, there is something fundamentally wrong—there is either a deliberate evasion of those social obligations impressed upon science from without, or there is a functional

disorder which produces the same result from within, because nobody has appeared in the arena of scientific endeavor possessed by the spirit of large social service offering to lead the way. Whichever the cause, the end result is the same, and one might well ask what scientific men, what medical men, have been doing all these years to justify themselves and to merit public faith and confidence in those principles they have so tenaciously expounded?

And yet, of course, scientific men, medical men, have been busy. They have admittedly labored long and painstakingly. But this is no impetuous outburst that can be stilled by the winking of an eye or the disdainful shrug of one shoulder. The difficulty seems to be that scientific men, and medical men, have been so busy with their instruments of precision and their test tubes in meeting the daily problems of life in the little sphere in which each has moved, that they have not given a thought to the larger obligation of co-ordination, of applying the simple rules of science to all scientific effort for the purpose of reducing waste and cutting out all useless duplication of effort and foolish loss of energy in their own domain.

This kind of a statement is bound to bring a storm of criticism. But with such a vigorous charge as that laid down by G. D. H. Cole, one of the latest social writers, a charge which it seems must be admitted and remedied before the present social chaos can be reduced and made to flow in that direction which will insure some decent measure of social stability, social safety, and intelligent social development, it is patent that some particular group of men—presumably scientific men, because they should know how to assemble facts, point out causes, and suggest obvious methods once the thing is gotten together in proper relation—it is patent they must assume the burden of devising a practical philosophy of life.

Listen to Mr. Cole:

"Orthodox social theory is bankrupt; it neither corresponds to the facts of today, nor affords any help in interpreting the tendencies which are shaping a new social order within the old."

Of course, Mr. Cole does not specifically accuse scientific men. Nor does he insinuate remissness on the part of medical men. But if social theory is bankrupt, it must be admitted that scientific men generally, and medical men particularly, should know the causes producing that bankruptcy, and knowing the causes, they are not functioning in full accord with their obligations unless they offer some practical plan in substitution. This is especially true of medical men, because they, of all scientific men, are the direct representatives of the individual and social well-being of all the people, and are possessed of exact knowledge concerning the effects of every individual and social degeneracy. With this knowledge, if they have not dug out the causes behind the effects they see every day, then certainly they have not risen to their job.

VIII.

Perhaps it may serve to clarify, as well as emphasize, the thought sought to be conveyed, to quote the following excerpt from the writings of Elie Metchnikoff, co-laborer with Pasteur:

"In order to modify human nature, it is necessary to realize what is the ideal in view, after which every resource of which science disposes, must be taxed in order to obtain that result. If an ideal is possible, capable of uniting men in a sort of religion of the future, it can only be based on scientific principles. And if it is true, as is so often affirmed, that it is impossible to live without faith, that faith must be faith in the power of science."

This observation was made by Metchnikoff about the time of the outbreak of the late world war. Beset with those innate impulsive emotions of his race, which were accentuated by the atmosphere in which he lived, and adjured by his powers of reason developed in half a century of scientific research, Metchnikoff, thoroughly intellectualized, saw through the social upheaval to its motivating causes and put his finger on the fundamental failure of all science—the failure to rationalize human life as by constructing within the social organism itself the machinery to give expression and direction to the individual ingenuity and to avoid the cumulative explosive element by employing all surplus energy in constructive channels.

IX.

The ideal having been fixed, the task having been set by a scientific man, it is the manifest duty of all other scientific men to either disprove the principle involved or to find ways and means of applying it beneficially. Thus again does history call into question the penetrative powers of The Torch of Aesculapius, for this statement was made by Metchnikoff as a part of a general epitome of the failures of medical science.

X.

All controversial questions aside, the present social problem in all its complexities presents the single greatest opportunity science has ever had to do two fundamental things: (1) to humanize itself by the co-ordination of all scientific endeavors so that the composite result will be a matter of every day knowledge among people everywhere, people who will be quick to grasp the full import of any plan which gives assurance of political, economic and social stability and welfare; and (2) to be of tremendous service to humankind everywhere in its effort to achieve a rational, cohesive, and purposive social organization in order that man may go about his daily work with an understanding of and appreciation for the part he and his neighbor play in up-building the common good. That, surely, is a big undertaking. But nothing attempted, nothing achieved; and certainly the problem of social direction is one demanding an application of scientific principles—the only known method which seriously offers any hope for the merging of diverse personal and secular interests for the common welfare without being overwhelmed by the lunatic fringe of apostasy.

XI.

Every man of medical science is foresworn to do two things: (1) to ameliorate human suffering and (2) to prolong human life. These are traditional. Medical men have thought they saw their obligation full panopied in curative practices. But of late years they are being mercilessly pressed from all sides to say whether the amelioration of human suffering confines the science of medicine to the mere treatment of a man's ailments once he has become sick, and whether the complementary part of the obligation "To prolong human life," has any larger meaning than that the maimed, the halt, the blind, shall be the indivisible responsibility and burden of the medical profession forever?

Reasonable minds have no difficulty in agreeing that the science of medicine is charged with a very definite responsibility concerning every thing which has to do with human perfection and happiness—general terms, granted, but inclusive, easily understood, and sufficiently elastic to prevent even the most virile and inquisitive mind from going soft through inertia apolied externally.

Reasonable minds also agree that the question of health is becoming every day more profoundly important to the man and woman who is not ill—a goal which can only be fully attained through the services of the medical profession—and through the medical profession only if it travels carefully and laboriously along the social road studded with all the solid facts that have already been discovered, and

reinforced by others as they are assembled day by day through the efforts of all manner of science—a road with whose vistas of human actions and reactions must be limned in precise knowledge of physiology, pathology and psychology.

XII.

Descartes, the ancient Greek, said:

"For the mind depends so much on the temperament and disposition of the bodily organs that, if it is possible to find a means of rendering men wiser and cleverer than they have hitherto been, I believe that it is in medicine it must be sought."

Clearly, the Ancients had no misconception of the true relation of medical science to individual development and the public welfare. It is problematical, however, whether the rank and file of the public today—indeed, it is questionable whether the medical profession itself, fully appreciates or understands the place the mother of all science must inevitably occupy in any sincere effort to build a constructive and intelligent social philosophy.

There is, of course, a very active spirit of ferment at work in the profession and out. The hue and cry about the socialization of medicine, as that term is ordinarily understood and used, is the outward evidence of a feeling that medical science is not functioning fully with respect to the social welfare. At best, that reform is but the coercive expression of public opinion—the reflex of an unfulfilled scientific obligation. But the fundamental failure of that method lies in the fact that it is, in the last analysis, a mere shifting of the responsibility for a proper and efficacious science of health from a specific scientific agency to an inarticulate and unscientific conglomeration of political and social forms.

Any student will agree with the proposition that the public welfare is paramount and that the general public should practice medicine in so far as that statement implies the possession and use of medical science in correct methods of living, hygienically, morally, physically and mentally. But this problem is not to be easily accomplished: it will not be achieved through the mere exercise of the political functions of our social institutions: the question of producing a social science of medicine is very different than the socialization of medical science.

Perhaps this distinction can be emphasized by saying that the thought projected contemplates that the original social responsibility of medical science shall be revived, and in conformity with that obligation, that medical science will develop for its own guidance and ultimate purpose an inclusive social theory. This is the only way by which preventive medicine, the new concept of medical science, can assume its proper place as a modern science, and beget a wholesome social mind through the intelligent good will of the public. It hardly seems necessary to add that only through the intelligent co-operation of the public can the science of medicine become a truly socializing influence of value; and that contrariwise, socialized science as an effect instead of a cause will become hopelessly involved in political travesty and economic legerdemain.

XIII.

With these thoughts very definitely in mind, The Radiological Society is attempting to develop a Research Department for the distinct purpose of co-ordinating and correlating the scientific work of existing agencies. This department does not labor under the presumptuous belief that it should, or could if it would, set itself up as the chief architect of all science. Rather, it is very appreciative of the earnest efforts, sacrificial labors, and intense zeal of many institutions and individuals now working out specific problems.

But it seems obvious a delightful impetus can be given to all scientific achievement by the development of proper means to secure the effective liaison of all scientific agencies, whether institutional or individual in character. This is the job specifically undertaken in order that all scientific workers may be certain of the effective co-operation of all other scientists, and that there may be maintained constantly and perpetually an authoritative source of information and aid for all worthy scientific efforts having for their object the attainment of a better science of health.

XIV.

It is the desire of those persons striving to visualize this entire problem that the transition from labor to refreshment and refreshment to labor, whether spiritual, mental or physical, shall be made as easy and as certain as possible in order that stimuli can always be found in the free and untrammelled interchange of scientific findings, scientific hopes, and the differentiation of scientific obstacles. The Torch of Aesculapius must be refurbished and kept burning at full capacity so that as it passes from the hands of all scientific laborers of today to the beckoning hands of tomorrow, its effulgence will be accepted as a guarantee of a high mark of scientific attainment and the unquestioned source of an abiding faith in the fecundity of scientific principles as applied to the public welfare.

Radiology and the Physician

OPINION is widely divided upon the question of the status of physicians who are practicing roentgenology. Is this specialist to be a heaver of wood and a drawer of water, or is he to be one of the architects of King Solomon's temple? For many years varying opinions have been voiced. One school holds that roentgen workers are laboratory workers and should only record their findings accurately and impartially, leaving the deductions to others. In therapy, they maintain, the direction of the treatment should be in the hands of a surgeon, internist, or some other physician. The roentgenologist should be the servant supplying the technical skill, but having no voice in the general direction of the case.

On the other hand, from the beginning, able leaders, outstanding men, destined by a dominating personality to become successful in whatever field of medicine they might choose, have seen the narrow vision of this line of reasoning. This school of thinkers maintains that the roentgenologist's place is alongside other consultants. They should give their opinion when sought by the general practitioner, the surgeon, or whoever handles the case, or by the patient seeking advice. Members of this school have usually graduated from a ripe clinical experience, or they have had the foundation of college training, hospital service, and apprenticeship with a competent physician. The future to them is bright and hopeful if they can aspire to the position of Hiram, the chief architect, and sit meanwhile at the council table.

A close analysis of the situation shows that at the present time the specialty has passed the division of the ways. Recent advances in the field of roentgen therapeutics make it imperative for the roentgen worker to be a master of diagnosis, of therapy, and to possess a broad knowledge of the basic branches of medicine—bacteriology, pathology, general diagnosis, medicine and surgery. Already they have accepted the tedious service necessary in preparation, have accumulated a broad clinical experience, have collected a fair-sized literature and have established liaison with the leading research laboratories of the world. No other field holds more interest today than physical research and biological experimentation on the effects of the roentgen ray on animal life in health and in disease. The experience

entitles roentgenologists to the dignity of equality in the councils of peers.

To be a mere technician (and that is what the first alternative means) attracts only laymen to the roentgen laboratories and a few physicians who are satisfied with little recognition and no responsibility. It absolutely dooms the future of roentgen development to mediocrity in the fields of diagnosis, therapy and research. It renders the field barren and holds no adequate reward for the physician who plans a future.

A parallel case may be drawn from the dental profession. That specialty is the only one in medicine graduating practitioners without a medical background. Today the leading dental colleges are adopting the longer courses in order to compensate for this deficiency in training. Most of the failure in co-operation with dentists arises in their lack of proper appreciation of health and its relation to oral hygiene. This is fast disappearing. But it is illustrated when we see some of the older dentists still placing bridges, fillings and other fair-appearing indentures in mouths that are infected; indeed, putting them often on teeth that are a positive menace to health. Such practitioners are not entitled to consideration as consultants. They are technicians, not specialists in medicine.

Men in other fields of medicine who have considered this phase of the subject hold no delusions. Their attitude is helpful. The leader of one of the greatest of modern medical organizations, Dr. Franklin H. Martin of the American College of Surgeons, at the last Chicago meeting insisted in strong language that roentgen workers should develop the field of therapy and "sit at the council table," and that they should not be satisfied to be "hewers of wood and drawers of water."

The ideal roentgenologist is either a diagnostician or a therapist, or occasionally both. He has learned from experience the need of medical co-operation necessary to advance the patient's welfare. He respects the limitations of his field. He knows the immense value of his special knowledge, and he is able to direct his own line of action.

E. W. R.

Recognition of the Radio'ogist

PUBLISHED in this issue of The Journal are the after dinner speeches of Franklin H. Martin, M. D., Secretary of The American College of Surgeons, and Frank Smithies, M. D., Secretary-General of The American College of Physicians on the occasion of the annual banquet of The Radiological Society. These speeches were given in response to the annual address of Dr. Alden Williams of Grand Rapids, Michigan, retiring president, who made a strong plea for the utmost spirit of co-operation between all the component parts of the medical profession.

By way of explanation, these two speeches, and those appearing in the February issue, are published because they represent the ideas of some of the most farseeing men in the profession, and it is the effort of The Journal to make its editorial section truly representative of the best thought in medical science.

The Journal believes it can serve the whole profession by championing the ideas of such men as have something really worth while to say concerning the inevitable reconstruction of medical practice that is now taking place, particularly those whose basic point rests upon those fundamental ideals which have come up with medical science.

It is recognized, of course, that The College of Surgeons and The College of Physicians represent powerful and intelligent influences shaping the development of medical science, and for that reason The Journal is proud to give place in its editorial section to the remarks of such eminent

men as Dr. Martin and Dr. Smithies, particularly in view of the fact that each embodies in his remarks a spirit of friendliness and mutual confidence for the Radiologist.

The Surgical Viewpoint

YOUR president made mention of another society this evening and I wish to very briefly compare the organization of that society with this one. Before doing that, I wish to congratulate you upon being a society of specialists, one that has been in existence but a very short time. I wish to congratulate you because you have very little to forget and no traditions to live down.

I wonder if you realize that this society really looks deeper into things than almost any other society? That this society practically looks beyond things and through things, and the only obstruction is a common house pin or a safety pin. And do you realize that that means that your business is a simple business? It is something that is almost too good.

Do you realize that to that mechanical "too goodness" you should add idealism? That, I know you have or this society in six years could not have grown into the society that it has. No society lives on pure mechanics. No society lives on pure science. It must have an ideal.

Your president has just given a hint that you have ideals and aspirations. He wonders why The American College of Surgeons in its minimum standard has not required that the roentgenologist in the hospital be a medical man. We did not think that would be necessary, but it is something we are very glad to have suggested, and it will be written in just as soon as public opinion will support it.

This organization must realize that it is probably right on the brink of doing work the most important that the medical profession will have to do. You are probably right on the brink of therapeutic work that will mean the control and possibly the curb of malignant diseases. You not only will be the mechanism, the picture maker, the searcher after things, but you will be great therapists. Let me urge this: That you do not remain any longer simply water carriers and wood choppers and assistants, but insist that the roentgenologist be a medical man and insist that he sit in at the consultation.

FRANKLIN H. MARTIN, M. D., F. A. C. S.

The Medical Viewpoint

DURING Dr. Martin's speech I thought that societies such as this should be known not as roentgenologists, but as actinologists, a wider term embracing all of the specialties along which you serve, yet at the same time lifting you out of the picture taker, water carrier, and developer class and allowing you to sit in at the consultation table. The successful actinologist is a successful internist. I have yet to find a man, a good outstanding actinologist who is not also a good internist.

In devising the new constitution and by-laws of the society I represent, The American College of Physicians, there has been abundant provision made for the introduction into that society of properly qualified actinologists, not only giving them a chance to come in, but to sit in. Already the society has admitted a number of men whose work has been outstanding. Provisions are being made for others. It will not be long before a considerable percentage of this organization become members of The American College of Physicians.

In our classification as being set down for the first grade hospitals, we are insisting that the direction of all laboratories of actinology shall be in the hands of properly licensed, properly educated and practicing physicians. We see no reason why work on which human life depends should

have as its deciding factor a photographer, a high grade photographer, 'tis true, but nevertheless a photographer. We feel that inasmuch as the actinologist's decision is final frequently and frequently the most important factor, that this decision should be laid at the door of a properly qualified doctor of medicine.

With regard to the future of this society and medicine, Dr. Warnshuis, I think, has emphasized everything completely. If I may steal a cowslip from Professor Johnson, I may say in addition to his faith, work and service, I would emphasize what Dr. Warnshuis has already mentioned—namely, vision.

A few years ago the internist and actinologist had a position closely exemplified by the corner figures in this room. They were flying at each other's throat, held back by some unknown influence. Today I am glad to notice they have gathered in these congenial groups you see at the side, presided over by a benign deity, but yet not sufficiently secure of their positions to warrant leaving out the end picture, namely, a guard against interruption.

FRANK SMITHIES, M. D., F. A. C. P.

British X-Ray Diplomas

THERE has been a good deal of discussion among American radiologists during the last two or three years relative to the scheme adopted by the British radiologists giving physicians a special degree distinguishing them as specialists in radiology.

The real working of this scheme has been rather hazy in the minds of most American radiologists and it gives us great pleasure to give at this time the exact facts concerning it.

The Journal of the Roentgen Society, in the October number, 1921, contains an editorial with the following explanation. During the last two or three years university diplomas have been established in the medical application of x-rays and electricity, and further, a special examination has been established for persons who carry out under medical direction, the technical side of this work. This statement shows that two kinds of university diplomas are issued—one which is issued to the licensed physician who wishes to take up radiology and physiotherapy as a specialty. The university authorities give a special course to this type of applicant, part of the course being given at Cambridge and part at London, under the auspices of the British Association for the Advancement of Radiology and Physiotherapy, which is purely a medical body.

Similar diplomas are granted at the University of Liverpool, and doubtless other universities will follow in a short time. The courses are intended to supplement the scanty instruction in x-rays and electricity which is obtained by the physician during the pursuit of study for the ordinary medical degree.

In addition to this a special diploma is given to laymen who wish to become technicians. This diploma is awarded to those who have a good general education and who are willing to sign an agreement that they will not examine or treat a patient except under the direction of a well qualified medical man. The examinations for this diploma are open to any one meeting these two requirements and showing a certain amount of experience in the practical side of x-ray and electrical work. For those who have had no practical experience in this line, special courses of instruction are provided leading up to the degree. The technicians have formed an association which is known as the Society of Radiographers, the medical men being distinguished from technicians by the employment of term Radiologist. This arrangement gives the technicians assisting in x-ray and radium work recognition for their qualifications and binds them

closer to the society of radiologists. The Society of Radiographers in Great Britain has a council, the constitution of which has been approved by the General Medical Council and Board of Trade. This council consists of six medical men appointed by the British Association for the Advancement of Radiology and Physiotherapy; six members of the Institution of Electrical Engineers and six members elected from the membership of the organization. An examination is held twice yearly and the successful candidate is entitled to use the letters "M. S. R."

Of course, at the present time it is not possible for us to adopt exactly the same scheme in America, due to the different method of licensing physicians and giving diplomas to men in special societies. This arrangement, however, offers a good suggestion for The Radiological Society in working out the details of the plan which was adopted at the last annual meeting, leading to co-operation between The Radiological Society and certain technicians.

A Communication

YOU, Mr. President, are responsible for this effusion, for you asked me to write a letter that you could read to your members, and, in a rash moment, I undertook to do so, and now, when I take up my pen, I have no ideas. Vistas of wonderful scenery among the Rockies, awful heat in the trains, great expanses of the open prairie lands, vivid colors of your lovely lakes, all these things are ready to hand, but there is never a suggestion anywhere on the blank page of x-rays and the things which ought to be straight on the point of my pen. I made an attempt to write this letter some time back and it was not at all successful, but there was one thing which just escaped through the bewilderment of the luckless scribe on that occasion—an overwhelming sense of his indebtedness to all his friends on the other side for the delightful time he had in June.

I found it all intensely interesting, but my wife persisted that your wonderful country was far healthier than x-rays, even your congresses. It gave me a rather nasty feeling, however, that I was less than polite to my friends who had so much to show me and so much to teach me. I knew that I should enjoy the x-ray part of the trip, but how much I hardly knew—in this country, no matter where I go, into little one room cellar departments perhaps, there is always something to learn, and when I came to your departments it was such a dose of new ideas, new apparatus, new personalities expressing themselves in their work, that I developed an acute attack of mental indigestion, and my wife won the day easily. It was less than courtesy to the splendid work I saw to dash along as I did. Even the tortoise Englishman can sometimes move a little—this one, for instance, travelled fifteen thousand, seven hundred and sixty miles, slept in forty-two beds and was back in his own home in eighty-two days.

If I were writing to English friends who asked me to do as your president has done, I should ask, "What on earth do they want me to talk about?" knowing quite well that they would want me to talk about themselves, how nice they were, what wonderful work they did, and all sorts of things of that class, whether true or otherwise. Now, I wonder if my friends on the other side of the water are any different from the people I know? I doubt it, for my friends this side are nice people, and, having told you how I would be expected to write for them—well, I won't do it for you, and if you want butter—well, there is quite enough on both sides of the herring pond to meet all contingencies.

At one period of my existence I lived at a University Settlement in the East End of London, Toynbee Hall. The settlers there were a curiously mixed lot, a most interesting crowd to live with, and one that loved fun that was poked

directly and indirectly at themselves—perhaps it was the contrast to the drab surroundings. Quite a number were engaged in the teaching profession and great was the joy when Bernard Shaw came down one day and put out one of his sayings that was filled with a half truth. It was: "Those who can, do; those who can't, teach." I just love that saying—I am now University Lecturer in Radiology, so perhaps your president thinks I am sufficiently incompetent to take on the roll of teacher! No, I don't think he asked me to write a teaching letter, although I really don't know what he wants, when he has papers on medico-legal and other dry-as-dust subjects as after dinner fare for his long suffering members.

It beats me entirely how you long sufferers stand eight or nine hours congress meeting a day, and in an atmosphere that is a fair sample of what I expect to attain when I pass to my appointed place.

Yes, there is a big difference in temperament on the two sides of the herring pond. Our audiences would melt into thin air after three hours in such conditions—you are more long suffering and tolerant, even when people get up and talk at length in a manner that shows they do not know their work.

I wonder how you would like a congress such as I would organize—nobody has yet asked me to do it and is not likely to, so, being a free lance, I can just let my fancy roam. The congress shall be held in Glacier National Park, and shall be held at such time as the birds have finished their nesting, when the earth is full of the promise of life and things to come, when the bear-grass is bursting into flower, when the snows are giving place to verdure, when the air is full of spring and the joy of life. There we shall meet, in the real "God's own country," and we shall learn some secrets that even x-rays will not tell us, and we shall walk and talk in the fullness of health, beneath the snow clad hills. Our first aim will be to know each other's minds. We would not work to schedule and we should each have a chance of five minutes in which to air our views on any subject under discussion, and we should criticise, or if incompetent to criticise, we should be content to ask questions. If we were polite we would compliment the opener on his extraordinarily fine exposition of the subject and would then proceed to dissect his theories, and, in all politeness, call him a fool for voicing such absurd views, and thereby lay ourselves open to the opener's scathing criticism of our hopeless ignorance. And every one having tilted at some one or something would take some part. Some people would get quite cross, even angry, but smell of the kitchens would quickly dispel this, and the sight of the hills would teach each of us what little microbes we are with our views of epoch making importance—in our own estimation. The president would insist that no papers be presented after

twelve o'clock, noon, and all work should be put aside at the lunch hour. Each member would have to be on the trails or on the hills at least four hours of each day, and in the evening there would be an option between a paper by the leader of those interested in something that I abhor, say, medical politics, and a lantern lecture on the geology or botany of the district.

Enough of this foolishness—I weary you, just as much as eight hours of papers, all read to schedule in a damnable atmosphere wearied me. Yes, your congresses are so intensive that human nature is left out of account, and the effect on me was a sense of bewilderment, in which I groped again and again through the mass of A.B.C., sometimes iterated and reiterated in almost German fashion, with the result that I was dazed and could not take in the many new points. Perhaps we English are different in our receptivity, perhaps your audiences are hardened to this fare, but for the poor, slow, old-world mind, your congress was something akin to a nightmare—it reminded me of the patience I played mentally at one time when fever was on me; openings occurred but were elusive, good things were always turning up, but before I had time to weigh them, I was directed to another pack and busy looking for openings in it.

And yet I enjoyed it all, every bit of it (except my own small share and the period about it), but still more I enjoyed meeting some of your workers, seeing a little of their work, getting to know some of the personalities that often did not express themselves in their writings. Yes, this was what I enjoyed most of all in the whole trip, a trip that was brim full of interest, and varied interest at that, for all the two short months I was on your shores. To one and all whom I met I would have you express the heartiest greetings and the grateful thanks of the stranger in your midst, a stranger who was made so welcome that he felt absolutely at home. I would that we on this side had some of your freedom from self-consciousness that would let us make you as completely at your ease when you come over here, as I trust many of you will endeavor to do. To have had the privilege of meeting your workers and seeing the conditions in which you work, has been a great treat, even though one is full of envy of the obvious fact that you have the money to spend on apparatus, while we struggle on, making the metaphorical old tin can and bootlace serve a useful, if unornamental, purpose.

And so, Mr. President, having written as you bade me, I make my bow, and hope that once again I may be with you in person when you meet in congress, particularly if I may join you all in Glacier National Park or in the Yosemite Valley.

I am your grateful guest,

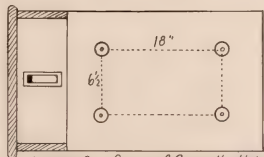
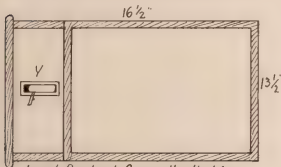
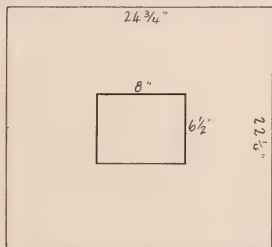
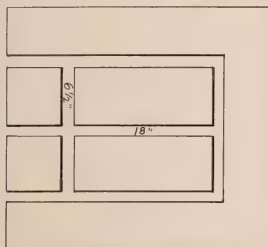
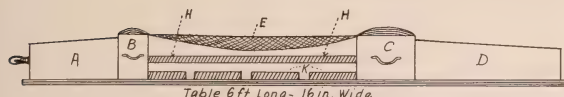
ALFRED E. BARCLAY.



DEPARTMENT of TECHNIQUE

A Modification of the Richards Table

H. H. MURPHY, M. D.,
Kamloops, B. C., Canada



Screw at end to tighten hammock E. A-Upholstered pad, 13 inches long.
B-Upholstered pad, 3 inches long. C-Upholstered pad, 8 inches long.
D-Upholstered pad, 14 inches long. E-Hammock. F-Lead covered shield.
H-Central aperture. K-Track for cassette holder.

IN an article in the October number of The Journal of Radiology, Dr. L. K. Poyntz refers to the Gastro-Intestinal Table designed by Dr. Richards of Toronto General Hospital. This table, which permits of fluoroscopic observation and palpation, provides for serial stomach work in the prone position, and by supporting the abdomen in a hammock, deformity of the stomach silhouette by spinal pressure is avoided.

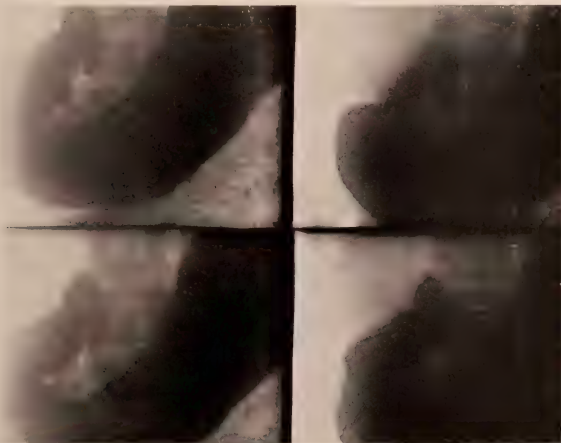
The following modification has been found by the writer to work satisfactorily, and by taking four serial views on a film eleven by fourteen there is not only a saving in material, but also an economy in the original investment of intensifying screens. It consists essentially of the Richards table and the usual eleven by fourteen serial stomach plate changing tunnel, which has been on the market for some time. The table measures sixty inches long and sixteen inches wide and can be used on any of the usual combination or wooden tables, and is equipped with four handles (on B. and C) for convenience in lifting. A and D are upholstered flat to support the head and legs, while B and C are hollowed out, five and one-half inches on the outside and three inches in the center, to support the chest and pelvis. From these supports the hammock—E—is stretched. The hammock can be tightened by screw X. H is a lead covered shield having an opening in the center eight inches by six and one-half inches. Underneath this is shown the track K for the cassette holder. After the patient has been examined in the upright and prone positions, he is placed prone on this table and the area of which serial radiographs is desired is placed, with the aid of the fluoroscope, over the opening in the lead shield. If the eleven by fourteen cassette is then placed in the holder and slid into position and held by catch Y, the first serial view is then taken, the catch released and the cassette pushed ahead into the second position; then across to the third and pulled back into the fourth.

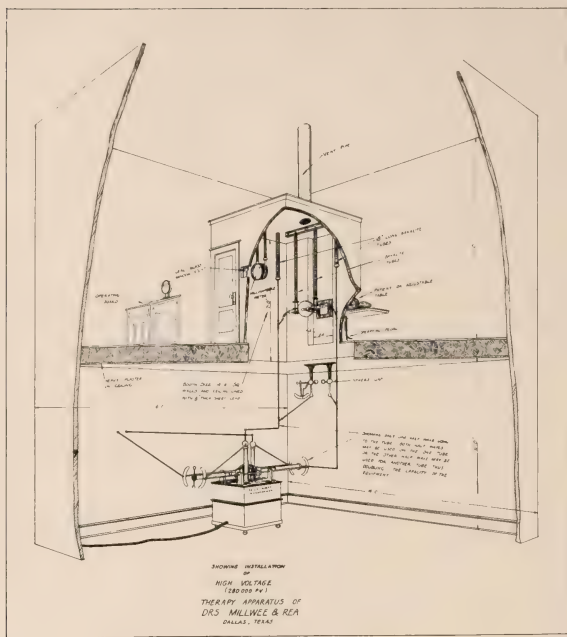
Methods of Protection in High Voltage Roentgen Therapy

ROBERT H. MILLWEE, M. D.,
Dallas, Texas

DURING a visit to roentgen ray clinics in Europe, I observed the extreme toxemias and dangerous blood changes incident to the administration of large doses of high voltage x-ray. These conditions have already been reported by various American observers.

In my own work with high voltage an attempt has been made to eliminate as far as possible, these undesirable after effects of the treatment by employing a type of installation which completely protects the patient from the dangers of electrical shock, unnecessary stray rays, noise, odor, and the sight of strange apparatus; any of which may result in con-





siderable shock to the nervous system and thereby change the blood picture or increase the toxemia.

After using this method for a period of eight months, with two hundred cases, I am thoroughly convinced of its value. Two hundred and thirty-five thousand peak volts are employed and larger doses are given than I observed in European clinics with much less toxemia and blood change. The toxemia is much less than when the same dose is attempted by either high voltage or with one hundred and forty thousand volts given in the ordinary way.

The installation is illustrated in Fig. 1, and may be installed for less money than an ordinary treatment table and tube stand.

It will be noticed that the transformer is located on the first floor of the house and the treatment room is upstairs. This is not essential as both may be placed on the same floor. The high tension terminals go direct to the tube without passing through a wall. A vent pipe in the top of the lead lined booth allows for ventilation. The lead lined wall is grounded. The lead is on the inside of the wall and the wall is composed of an inch of wood and one-quarter inch beaver board. The tube is

fixed with the target nineteen inches from inside the wall, so, with the patient against the wall it is possible to secure a twenty inch skin target distance. A thirty-six inch skin target distance is most usually employed. An adjustable diaphragm as is employed in fluoroscopic work is fixed in the wall and compression cones made of wood with a flat compression surface are employed in order to flatten the field exposed as much as possible. These cones are of various lengths and the sides are lined with leaded ray proof rubber. The length of cone used depends on the skin target distance desired. The size of the column of primary ray is regulated by the diaphragm and the leaded rubber lining of the cones absorbs the stray or scattered rays so that no ray reaches the patient except that which is directed to the pathology.

Most all patients will assume a position on the side for a much greater length of time with comfort than on the back or face. If it is desired to treat from the back or front, the patient is placed on the side, and all pelvic cases are placed on the left side and the head of the table is lowered slightly to allow the small intestines to fall out of the pelvis and the sigmoid will usually fall sufficiently to the left to be out of the more intense central ray.

An ordinary surgeon's table, with the various adjustments, equipped with an improved wood top and covered with a mattress, may be used, and it is best to have it equipped with casters so it may be rolled about. In my installation the operating switch board is placed on the opposite side of the lead lined booth from the patient and the operator observes the patient by means of a large mirror on the wall.

The transformer is constructed to operate two tubes so that another tube may be mounted in the same booth and the ray directed through the opposite wall, and in this case the operator could be placed at a distance from the end of the booth and observe the two patients, one on either side of the booth, at the same time.

Two booths could be used and the patient placed between the booths and a tube from each booth used on the one patient and thereby lessen the time of treatment. But since there is nothing to indicate that it is desirable to shorten the time of treatment, but, on the contrary very reasonable argument other than clinical evidence to indicate that it may be desirable to even lengthen the time of treatment, I do not believe that we shall very soon find the necessity of using more than one tube on a single patient.

To deliver a dose of high voltage x-ray to a deep seated malignancy, such as in the pelvis, requires about five hours treatment. Most such cases are women and past fifty years of age, and unaccustomed to such apparatus as seen in an average x-ray room. And, furthermore, such patients have most usually been informed of all the dangers of roentgen treatment. To place such a patient on the average x-ray table and with a spitting x-ray tube suspended from above, require her to remain quiet on her back for hours at a time is sufficient to shock the nervous system beyond repair.

Less than two per cent of my patients have been sufficiently toxic to vomit. I also find that my patients do not complain of taking treatment and if they have ever had treatment elsewhere, they never fail to express an appreciation of the method.

We seem to encounter greater toxic effects when the same dose is attempted with our ordinary one hundred and forty thousand volts than with the two hundred and thirty-five thousand volts, so if we are to continue the use of ten inch spark gaps for deep therapy, I believe this type of installation to be of especial importance.

A word of praise for the American manufacturers of high voltage apparatus: Two of the new high voltage Coolidge tubes have been operated at two hundred and thirty-five thousand peak volts with a Kelley-Koett transformer for a period of seven months without the slightest trouble with either tubes or transformer.



NEW EQUIPMENT

Acme Stereoscope

RADIOLOGISTS will appreciate the finer technique of the Acme Stereoscope. It has always been one of the regrets of radiologists that they have not had a stereoscope so constructed as to make possible the vertical adjustment of the mirrors. That is one of the outstanding features of the Acme Stereoscope. With this apparatus the problem of properly aligning, vertically and horizontally, stereoscopic negatives, is met by means of a knurled screw controlling the adjustment of the mirrors at any angle and another adjustment which affords a sidewise tilt. Altogether the operator with this apparatus has four different adjustments which offset variations in vision, as for example, those due to astigmatism.

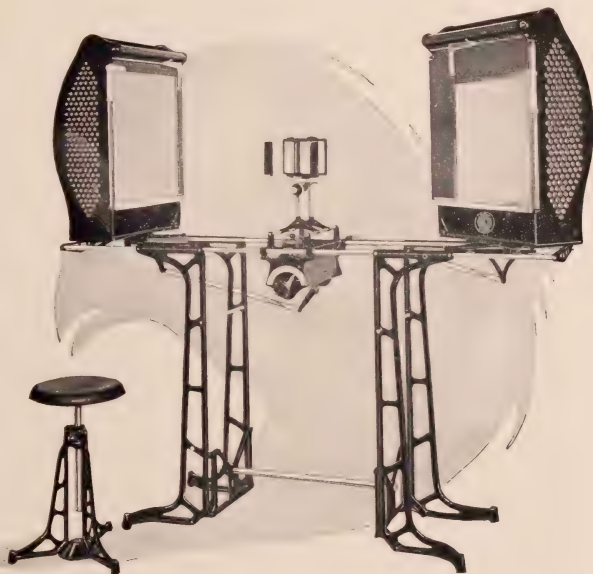
The illuminating boxes of this apparatus are equipped with four seventy-five watt day-light lamps each. These lamps are so placed as to give indirect illumination, thus insuring an evenly diffused light. Sufficient ventilation has been provided to eliminate all heat. The maximum distance between each box and the mirrors is twenty-five inches. This distance is varied or controlled by means of a handle upon which a dial is mounted. The dial shows the exact distance in inches between the boxes and the mirrors. Ball bearings insure easy manipulation of moving parts.

Probably the most important feature of the Acme Stereoscope is the dimmer control or rheostat which is so finely graduated as to enable the operator to increase or decrease the intensity of light to suit his needs. This is particularly advantageous in viewing negatives which have been over or under exposed. Plates other than stereoscopic negatives can be viewed in one box by turning a snap switch which automatically disconnects the other box. All adjustments, including the dimmer control, are located immediately in front

of the mirrors, where they are easily accessible without the operator taking his eyes from the mirrors when viewing negatives.

The Acme Stereoscope is constructed en-

tirely of metal, finished in enamel and highly polished nickel. The metal frame is rigid and so compact as to conserve floor space, occupying only forty-three by eighteen inches.



Wilmot Castle Sterilizer

EVERY completely equipped office of medical and dental practitioners requires sterilizers of one kind or another. The Wilmot Castle Company of Rochester, New York, has lately perfected four models of sterilizers which may be of interest to radiologists, particularly those engaged in therapy of superficial and deep seated malignancies. The first one is a small sterilizer coming in three sizes, 10 $\frac{1}{2}$ x5x3 $\frac{1}{4}$, 13x5x3 $\frac{1}{4}$, and 16x6x3 $\frac{1}{2}$, and is designed especially for instrument sterilization. It is intended for office use and for use in wards and dressing rooms of hospitals. This sterilizer is substantially constructed. The entire bottom is cast in one solid piece of brass. The legs, faucet and lifting lever for cover are brass. Other parts are made of heavy copper and the inner surfaces are all covered with pure tin—outer surfaces are heavy nickel plated. This apparatus comes equipped with six feet of cord and

connecting plug and can be operated from any ordinary light socket. This equipment has two features which may be of interest: First, by pushing down on a lever, the cover opens and the instrument tray comes up out of the boiling water. The tray is so designed that it will not tilt or upset. Second, an automatic device which shuts off the heat before all the water is evaporated, together with an emergency switch protecting both the sterilizer and instruments from overheating.

Another new model, mounted on white enamel tubular steel stand, for the sterilization of both water and instruments, comes in two sizes. One with an instrument sterilizer 13x5x3 $\frac{1}{4}$ inches, water capacity sterilizer, two gallons, floor space 25x12 inches, and the other with an instrument sterilizer 16x6x3 $\frac{1}{2}$ inches, water sterilizing capacity three gallons, floor space 33x13 inches. This design is constructed especially for eye, ear, nose and

throat specialists and physicians requiring sterilization of water and instruments.

The model known as 1410-D incorporates all the advantages of the other designs with the additional feature that it is mounted on a frame enclosed in cabinet form, where dressings, supplies, etc., may be stored for convenient use. This model comes in three sizes, occupying a floor space of approximately 19x31 inches and contains a cabinet 9 $\frac{1}{2}$ x16x14 inches.

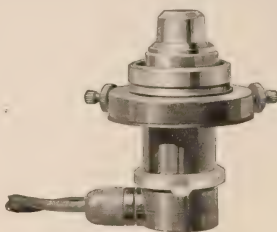
The fourth model is a combination sterilizer and table equipped with the standard Castle electric sterilizer in thirteen inch size, so placed as to permit the handling of sterilized materials from either the front or the side. It has a tray mounted on swinging bracket and closing under the table top when not in use. The cabinet of this model is large and will store a large supply of dressings or other material.

Spencer New Dark Field Illuminator

SPECIALISTS engaged in microscopic work will appreciate the value of the new Dark-field Illuminator lately perfected by the Spencer Lens Company. This is a combination of Darkfield Illuminator and electric lamp, making dark field examination much more simple and effective. This instrument was designed by the collaborative efforts of Major G. B. Foster, Jr., other officers of the Medical Corps of the Army Medical School, and the specialists of the Spencer Company, whose effort was to obtain a compact instrument and overcome as much as possible the difficulty so generally experienced in obtaining proper illumination.

In this device the illuminant is an integral part of the instrument. Because of the close proximity of the light source, a small con-

densing lens has been placed between it and the condenser proper. The illuminant is a



low voltage bulb, so mounted in a telescoping sleeve that it may be moved to and from the condensing lens for the purpose of focusing the light properly for the illuminating system. By means of the smaller of two sets of centering screws it may be centered to the optical axis. Larger screws provide independent means of centering the lens system.

The apparatus in question fits the substage rings of all standard makes of microscopes. The necessary current may be obtained from any lighting circuit by using a suitable transformer for alternating or direct current. Storage and dry batteries may be used. The instrument is supplied in a plush lined case with receptacles for funnel stop, light cord, slides and an extra bulb.

CASE REPORTS

CASE REPORT. H. A.

N. J. NESSA, M. D.,
Sioux Falls, S. D.

MALE. Age, twenty-seven. Occupation, auto mechanic. Family history, negative. States that he has always enjoyed excellent health. Has had many injuries to the

limbs of the body, which has caused frequent stays in the hospital.

Present complaint, pain in the region of the left iliac crest following an automobile injury.

The following plates show the presence of exostosis at the ends of all long bones; and so far as the patient knows he has had these

from the time of birth. There is no history of the patient's ancestors having any similar deformity.

He is a well developed, muscular individual, five feet, seven inches tall.

He states that for examination of this condition he has been frequently x-rayed, in the United States, as well as in Europe.

NON ROTATION OF THE COLON

N. J. NESSA, M. D.,
Sioux Falls, S. D.

MALE, J. J. Age, twenty-six. Weight one hundred and forty-three pounds. Ex-service man, referred for x-ray gastro-intestinal diagnosis with tentative clinical diagnosis of gastric ulcer.

Patient complains of stomach and bowel complaint during the last two or three years. Has distress intermittently in the epigastrium, having had on the average of two attacks monthly, each attack lasting for a few days. The distress comes on two hours after meals and is relieved by food.

Vomits occasionally; bowels constipated; has lost sixteen pounds in six weeks. Appetite is fairly good.

The gastro-intestinal examination shows the presence of a six-hour gastric residue with tenderness over the duodenal bulb and McBurneys. The duodenal bulb fails to fill evenly.

In studying the head of the barium you will note that the filled colon is on the left side. This when observed in twenty-four hours, as well as being injected by a barium enema, shows the entire colon on the left side.

The diagnosis in this case was suspected duodenal pathology with the associated anomaly, namely: non-rotation of the colon.

CASE REPORT

A. F. TYLER, M. D.

THE following case report is of interest because of its rarity and because of the unusual termination.

Mr. K. C. Age, twenty-nine. Came complaining of pain in the liver region, referred through to the back under the right shoulder blade. When he is working, if required to stoop much it brings on the pain. Physical examination showed nothing of importance ex-



cept that pressure over the region of the cecum produced pain, which he located higher up under the costal margin. Upon pressure in the cecal region the patient would exclaim that that was the kind of pain he had from stooping.

X-ray examination revealed a calcareous deposit measuring about one-half inch in diameter, in the center of which was imbedded a steel pin, the point of which extended out beyond the calcareous deposit. The calcareous portion could be moved about by pressure on the abdomen over the region of the cecum, while under fluoroscopic visualization. By



manipulating the pain could be definitely produced.

The patient refused surgical interference, but a few months later, while under heavy muscular stress, he was taken with a sudden pain in the abdomen, after which he felt very sick, and within a few minutes he had a large stool composed mostly of pus. The second stool produced pain at the rectal sphincter, and in a few minutes the enterolith containing the pin passed with the stool.

The accompanying illustration is a radiograph made of the enterolith after passage from the body.

CASE REPORT

A Case of Unusual Bone Formation in the Region of the Elbow Joint.

H. H. MURPHY, M. D.
Kamloops, B. C., Canada.

MISS L. B. Unmarried. Age, thirty years. This patient was referred to me by Dr. R. W. Irving for roentgen study. She com-

plained of pain over the external condyle of the right humerus. She is a stenographer and in reaching for a letter file, struck her elbow on the door of a safe three days previously. She gave a history of having injured the same region in the same manner a year previously. Pain and tenderness had persisted for some days and she had experienced "rheumatic" pains at times since.

Around the region of the external condyle of the humerus there was some swelling, marked redness and tenderness so that a clinical diagnosis of periostitis would have seemed justifiable. Fig. 1. is from a negative taken at this time. An exact diagnosis was difficult, as the small mass slightly attached to the external condyle did not have the appearance of either a recent fracture or of an un-united fracture of one year's standing.

The only other possibility considered was that of the traumatic type of myositis ossificans mentioned in Rose and Carliss Surgery, eighth edition, page 416.

In case that it was a recent and atypical fracture, the arm was placed on an internal angular splint, and Fig. II represents a print from a second negative taken when the print was removed. It will be noticed that the question of diagnosis was now further complicated by the almost complete disappearance of the formation in question. All that is visible in Fig. II might be explained on the diagnosis of an ossifying haematoma, but this does not explain the mass present in Fig. I. If this was an un-united fragment following fracture one year previously, then why the rapid absorption when the joint was placed at rest? If it was actual new bone formation of one year's duration, its disappearance is equally difficult to explain.

The three days which elapsed between the second injury and the taking of the first radiograph is quite insufficient for this formation, and if it was the result of fracture, we are again at a loss to account for its rapid absorption.



ABSTRACTS and REVIEWS

Pelvicography: Its Field and Its Limitations. James G. Van Zwaluwenburg, M. D. *Journal of Radiology*, March, 1922.

A DIRECT comparison between exploratory laparotomy and pneumoperitoneum is not justified, in the author's opinion. If the earlier data of the former method were compared with the data obtainable on pneumoperitoneum the comparison would be more nearly fair. The information one may hope to gain by either method must be taken into consideration and not simply the dangers of the two methods compared.

On the other hand, proponents of inflation are under obligation to prove that their method is much less dangerous than surgical procedure because of the fact that the information obtainable by the x-ray is less than that by laparotomy, and until the method is in use longer its lesser danger cannot be proved.

Something over three hundred and fifty cases have been inflated at the University of Michigan Hospital up to date, with no harmful results of any kind.

The introduction of gas by way of the uterus is free from objections ordinarily brought against abdominal puncture, but there is danger of carrying infection along the fallopian tubes and into the peritoneal cavity and also there is danger of inducing abortion. Therefore, in all cases of suspected pregnancy a thorough clinical examination must be made before deciding on the method of inflation. The uterine method furnishes valuable information as to the condition of the tubes and the bearing of this upon sterility.

Of the three hundred and fifty cases examined one hundred and fifty-three have been confirmed either by operation or by time in the case of pregnancies. In all cases the conclusion was drawn from the stereoscopic image alone—an unnecessarily severe test—though a joint opinion with the gynecologist was arrived at before any operation was performed.

Because the pelvic cavity is approximately cone shaped, the bundle of rays must fall from above, otherwise the ray would meet the pelvis at a broad angle. For these reasons the tube must be placed above the patient. The most important feature of the technique is the inclination of the patient to the horizontal because the uterus must hang fully suspended from the floor of the pelvis so that the ray will fall vertically in the axis of the uterus. This position is not possible with every case. The bladder and colon must, of course, be empty.

In the case of large tumors clearly of pelvic origin, and in uncomplicated pregnancies, there is little to be gained by this method. On the other hand it is possible to confirm the opinion of the gynecologist that an obscure abdominal mass is not of pelvic origin. Dermoid cyst and pelvic abscesses have been found in normal pregnancies with no harm from inflation.

The demonstration of a normal pregnancy presents least difficulty between the sixth and the sixteenth week. After that or before the method is either useless or superfluous.

Ectopic pregnancy has presented difficulties in this series through the diagnosis of an ectopic pregnancy has been corrected to read complication by extrauterine condition.

The method has several bearings upon pelvic tuberculosis, also the patency of the tubes in

sterility and a negative diagnosis in the case of neurotics are valuable contributions of this method.

The pelycogram is singularly sensitive to relatively slight changes in morphology and relationship of the pelvic organs and so the pelvis which appears normal to the sophisticated x-ray eye is without significant pathology.

The best evidence of the value of the method is the attitude of the Department of Gynecology of the University Hospital, which refers selected cases in undiminished numbers to the roentgenologist, and staff disputes, are being constantly settled in this way.

Co-operation between the roentgenologist and the gynecologist is imperative and has existed in unusual degree at the University Hospital.

A more complete discussion of this subject was under way at the time of the author's death.

Pulmonary Syphilis. Frank Conlin, M. D., Omaha. *Journal of Radiology*, March, 1922.

A RESUME of the literature is first given. Fowler's classification of the forms of the hereditary and of the acquired type are given and followed by a description of each.

Diagnosis of pulmonary syphilis is a diagnosis by elimination, as there is nothing absolutely characteristic in the clinical history or physical signs. Often a supposedly pulmonary tubercular patient dies for lack of anti-syphilitic treatment.

Pulmonary tuberculosis and syphilis may co-exist. Tuberculosis affects the apex and later the apex and lower lobe of the lung, while syphilis is more likely to involve the hilus and the base. Tuberculosis tends to cavitation and syphilis to fibrosis. Syphilis frequently causes stenosis of the trachea and bronchi, while tuberculosis seldom does. Tuberculous lesions are common, syphilitic lung lesions are rare and syphilis is more frequently unilateral and circumscribed than tuberculosis. A review of the literature fails to show that spirochaetae have been demonstrated in lung tissue.

The x-ray is invaluable in the diagnosis of pulmonary syphilis. It frequently shows a flame shaped shadow about the region of the hilus with fibrous shadows running out along the septa; while this is not absolutely characteristic it is very different from the shadow cast by pulmonary tuberculosis.

The physical signs and symptoms are dependent upon the location and character of the lesion. The absence of the tubercle bacillus upon repeated examination, a history of syphilitic infection plus other manifestations of syphilitic infection in other parts of the body, a positive Wassermann reaction, the good appearance of the patient contrasting with the gravity of the physical findings and the severity of the symptoms are all things which aid in the diagnosis.

Prompt anti-syphilitic treatment brings surprising benefit to the patient.

Pulmonary syphilis renders the subject more liable to pulmonary tuberculosis, which will pursue a very rapid course if the syphilis is active and virulent, but if it is an old syphilitic infection the case may be without fever and tend toward the chronic fibroid type.

In treating pulmonary syphilis co-existing with pulmonary tuberculosis the use of potassium iodide must be guarded.

It must be understood that subsidence of symptoms and a clearing up of physical signs does not mean a cure. The blood Wassermann test and the spinal fluid Wassermann test must remain negative for several years after the last anti-syphilitic treatment before the patient can be pronounced cured.

A detailed case report is given. The x-ray and the blood Wassermann test bore out the suspicion that it was a case of pulmonary syphilis. Treatment by novarsenobenzol, mercurial inunctions, and potassium iodide resulted in the entire disappearance of clinical symptoms and physical findings and a gain of forty-six pounds in weight at the end of a two and one-half year period. The Wassermann test still gave plus three, but the patient considered himself cured and declined further treatment.

X-Ray Spectra Produced Under Various Experimental Conditions. William Duane, Professor of Bio-Physics, Harvard University. *Journal of Radiology*, March, 1922.

RECENT research in radiotherapy indicates that much can be gained by the employment of penetrating x-rays in the treatment of certain diseases in which the diseased tissues lie some distance below the skin. As a rule x-rays of short wave length penetrate further than x-rays of long wave length. Examples are given in which matter of high atomic weight absorbs short rays to a much greater extent than it does long rays. In tissues the rays ordinarily used carry with them and deposit at a distance below the surface more radiant energy, as compared with the amount absorbed by the skin, if they have short wave length than if they have long. This is due to several causes; if the primary beam consists of short wave length rays it will penetrate intervening tissues more easily and also the secondary and tertiary radiation that comes from surrounding tissues will bear a greater ratio to the primary beam; further, the fraction of the energy of the cathode rays transformed by the x-ray tube into the energy of x-radiation increases markedly as the wave length of rays decreases, and lastly, a much larger portion of the x-radiation passes through the filters if the primary beam contains x-rays of very short wave length.

Thus, it becomes a problem of primary importance to study the spectra of x-rays produced under various conditions. Particularly for deep therapy there must be determined the best method of generating very short rays and of filtering out the long ones.

The author gives an account of some experiments on the spectra of x-rays that have passed through certain filters. "The first examples illustrate normal absorption of the x-rays (absorption increasing with wave length), then abnormal absorption where the x-rays of short wave length are cut off by the filter to a much greater extent than are x-rays of longer wave length." Experiments on the spectra of x-rays produced by different methods of exciting the x-ray tube are described. In particular the spectra produced by a constant non-fluctuating voltage and by an alternating voltage have been compared with each other.

The apparatus and method of investigating the spectra are described and the apparatus illustrated. Emphasis is laid upon the location of the tube and the spectrometer and the position of the target.

Calcite was used as a reflecting crystal in these experiments. It was set at varying angles (and the ionization chamber at corresponding angles), and by measuring the ionization current for each angle data was obtained from which curves were drawn to represent the x-ray spectra. A constant voltage of one hundred and sixty-one thousand volts drove a current of one milliampere through a Coolidge tube with a tungsten target. The absorber (or filter) consisted of a sheet of copper .48 mm. thick. The crystal used was equivalent to about 1.5 mm. of aluminum.

With the aid of illustrations the interpretation of the spectra curves is given.

All chemical elements have characteristic wave lengths at which abnormal absorption occurs. Data has been obtained at Harvard and ionization curves drawn that determine the positions in the spectrum of these characteristic wave lengths for almost all of the chemical elements.

The character of the exciting voltage is shown to have great importance in the estimation of dosage.

Examination of the spectra of the x-rays produced by each type of generating plant is recommended as the safest plan to follow.

The Control of X-Ray Therapy in Hyperthyroidism by the Basal Metabolism Test. H. M. Jones, Ph. D., University of Illinois. Journal of Radiology, March, 1922.

THE metabolism of the human organism may be defined as the sum total of the chemical changes going on in the cells of the body. To measure the rate of metabolism it is necessary to measure either the rate of heat production or the rate of chemical interchange above mentioned. This reduces to the task of measuring the oxygen intake. The final result is stated in terms of a plus or minus per cent of the patient's so-called normal rate.

Muscular effort and food absorption have an effect upon the rate, therefore the test is preferably given in the morning before breakfast, and with the patient lying down for from twenty to thirty minutes before the test is made.

A concise table giving rates of metabolism for both sexes and for ages from six years to eighty has been compiled by Aub and DuBois. Any deviation of ten per cent from the normal rate is the basis of diagnosis for some twelve to fifteen pathological conditions of which there may be combinations.

The test is used only for diagnosis of thyroid and pituitary abnormalities because the diagnosis for other conditions in which it might apply is more easily made by other means.

It must be kept in mind that in a suspected case of hyperthyroidism these other pathological conditions may be effecting the metabolic rate, and also that in the presence of symptoms suggesting some other pathological condition the basal metabolism test is the only means of recognizing the beginning of hyperthyroidism.

Froelich's syndrome can often be distinguished only by means of the test. Addison's disease is often confused with myxedema and thyroid therapy controlled by metabolism determinations will differentiate these.

The test is most valuable in border line cases. As to its being an index to operation the Mayo brothers believe that a patient showing a metabolic rate of plus forty per cent with an upward rate is a more dangerous risk than one with a rate of plus sixty and

a downward rate. Age, nutrition, condition of the heart and other factors must also be taken into consideration.

The surgeons' objections are that much of the gland may be destroyed, thus causing hypothyroidism, also many patients show no response to the treatment and the delay is made at the expense of myocardium. The radiologist in reply objects to surgery on the same grounds.

Personal opinion and wrong diagnosis at the outset is responsible for many false conclusions. Also irregularity of dosage and variations in technique have led to a multiplicity of opinion for and against roentgen ray in hyperthyroidism.

The secretion of the thyroid is unquestionably diminished by x-ray treatment, and, following wrong diagnosis, havoc has sometimes been wrought. Too small or too large dosage likewise brings disaster. A more perfect dosage is yet to be developed.

The advantages are summarized as follows: No fatalities, no scar, no interference with the patient's occupation, it is painless, and if it is unsuccessful an operation will be less difficult.

Means and Aub believe that surgery should be employed only after roentgen rays and other methods have failed. Some one hundred or more investigators show that the roentgen rays have a curative effect on hyperthyroidism.

The most important uses of roentgen ray in these cases are in treatment of those showing a minor degree of toxicity and reducing the toxicity in more severe cases previous to operation.

A Philosophy of Social Progress, by E. J. Urwick, M. A. (Oxon), Director of the School of Sociology, London; Tooke Professor of Economic Science, King's College, University of London, and President of Morley Memorial College, London, Published by Methuen and Co. Ltd., London. American rights, George H. Doran and Company of New York City. Second Edition Revised.

THERE is something strangely fascinating about this book. The author meticulously examines all of the social aspects from which the usual approach is made to the large problem of modern society by sociologists, economists, and religious savants. In a very precise way he points out the deficiencies and limitations of each reform program and shows that there is lacking in all of them that binding philosophy of life which opens up the well-springs of spiritual attainment.

But a thoughtful reading of this book leaves one with a feeling that while Dr. Urwick so carefully prescribes the limits of dogmatic science, whether medical, political, economic, religious, or social, as a premise for his argument that the real social progress cannot be accomplished except by the painstaking development of a philosophy "which is based on recognition of the fact" that the supreme purpose of human life, whether individual or social, is a spiritual purpose, even as the sole interpretation of its significance is a religious interpretation, still he unconsciously displays a feeling that perhaps science may yet shake off its chains and provide the machinery for the consummate expression of human life, intellectually, physically and spiritually.

A comparison of two or three excerpts may clarify the point sought to be made:

On page 201, in the chapter entitled "Real Purpose of Social Progress," he says:

"We will and must work to make any one healthier—not in order that he may be a more efficient person, or a more fully satisfied self, but in order that he may be better equipped to be a victor in

the fight against the world, the flesh, and the devil. * * *

It would seem that, for ordinary purposes, here is a distinction without a difference, for it is hard to conceive an effective health program which contains no resulting physical or mental efficiency, or no self-satisfaction.

Again, on page 211 of the same chapter:

"And if the medical specialist or any other specialist informs us authoritatively that this or that remedy will produce this or that desired improvement of health or welfare, then it is difficult to avoid the adoption of the measure recommended as a part of that universal provision of the conditions of well-being which every civilized community is constantly increasing."

So that in the one case the author in effect denies the larger possibilities of science, while in the other he recognizes the value of the medical specialist's advice when it comes to the question of individual and social health.

And finally, in the last chapter of the book, the last paragraph, on page 239, under the head of "Final Criteria of Social Progress," Dr. Urwick sums up his entire argument with the statement:

"We aim at making social life more perfect—the right aim, of course. But we interpret this to mean that social life is to be made easier, simpler, pleasanter—qualities which have nothing to do with the true purpose. We know, of course, that society will never be perfected, any more than will any of our environments, from our bodies to our churches. But we refuse to see that this continuing imperfection is a necessary part of their excellence as material for our wills to work upon. We think that by our hygienic and therapeutic ingenuities we are going to make society healthy; by our economic ingenuities to make it better off; by our political ingenuities to make it contented. If these desirable results occur, it will not be from these causes, nor from any ingenuities whatever."

Wherefore, to escape the accusation of subscribing in these words to the doctrine of whatever is, is right, and whatever is to be, will be, Dr. Urwick adds:

"Most probably they will not occur; we may escape from cholera and typhus only to find our health threatened by greater nervous instability; we may increase wealth tenfold, only to find a growing consciousness of want permeating our whole community; we may establish good government and good management, only to find unsuspected forms of social unrest producing new and harder problems of social adjustment. For that is the way with our ingenuities; they are never quite ingenious enough to solve any of the problems of life. * * *

Which, stripped of all useless verbiage, is to say that one may as well die with a known ailment with equanimity rather than to fly to evils he knows nothing of.

That is why the author concludes a social philosophy which will carry all men through is paramount in importance. And perhaps that is why, too, he turned to an intangible and unscientific thing for the answer to the great social problem rather than to attempt the laborious and perilous job of marshalling the forces of all science into a comprehensive and intelligent program to achieve those things which the author admits are essential to the social welfare. But that is to be the question at issue. That kind of a program is not sufficiently didactic to be applicable with any force in a practical world.

However, it is not the purpose of this review to enter into a long-winded discussion

of the fallaciousness of so summarily disposing of such a vital problem. The thing in which the readers of *The Journal of Radiology* are, or should be interested, is the fact that Dr. Urwick stresses the question of public health as the point of entrance to any real study of our socio-economic and workaday customs. And having done this, he lays a heavy burden upon the medical specialist by saying that when the latter speaks authoritatively, his recommendations should become a part of the daily regime of life.

All which emphasizes the responsibility which the votaries of medical science carry as a factor in social life, a science which can if properly and intelligently directed and made to function, do much toward developing and bringing into existence that "Philosophy of Social Progress" which Dr. Urwick so keenly appreciates to be the only thing which will give a sense of deliberate purpose to, and establish a reasonable degree of security in, individual and social effort.

Without splitting fine hairs over the questions raised and discussed, Dr. Urwick's book is well worth reading. It gives an entirely new view concerning modern sociology, and whether one agrees with him or not on some of the issues raised, one cannot study the book thoughtfully without perceiving that the author is a clear thinker, in the main, is a keen analyst, and is trying to focus his vision on an orderly and articulate social structure.

Social Theory, by G. D. H. Cole, Fellow of Magdalen College, Oxford. Published by Frederick A. Stokes Company of New York.

"I assume that the object of social organization is not merely material efficiency, but also essentially the fullest expression of all the members. I assume that self-expression involves self-government, and that we ought to aim not merely at giving people votes, but at calling forth their full participation in the common direction of the affairs of the community."

"* * * Orthodox social theory is bankrupt; it neither corresponds to the facts of today, nor affords any help in interpreting the tendencies which are shaping a new social order within the old."

WITH these stinging words the author closes a book which challenges attention by reason of its careful analysis of the present social imbroglio, and because he so exactly and clearly defines such words as "Community," "Society," "Association," "Institution," "Custom," "Family," and "State"—words which roll off the tip of men's tongues glibly and interchangeably without any particular thought being given to their derivation, their source, or their proper application in a sensible discussion of the complex problems of human society.

According to the author, and one can hardly deny the assertion, much of the present puerility of modern social theory grows out of a desire to personify the State. When, as must be realized on sober second thought, the "State," like all other common institutions, is nothing more than an association of individuals created for a distinct common purpose. Following the same line of reasoning, Mr. Cole correctly concludes that the family, the church, the political party, the social club, the town, are likewise associations of individuals, differing in degree, but not in kind; and that, therefore, they cannot be imbued with the power to think for the individuals constituting them. Their sole purpose is to perform such specific functions as are vested in them by the common will of the persons composing them.

The author discusses one after another the forms of social theory, their functions, and their underlying motives from the social, the political, the economic, and the religious viewpoint. The book appears to be truly the work of a master mind, grounded firmly in a correct understanding of the principles of human conduct.

In a very adroit and yet a vigorous manner, Mr. Cole strips the various social units of all the over-all and over-awing influences and powers sought to be invoked by the proponents of state socialism of every kind, divests the state as a political organism of that omniscient sovereignty which so many social theorists employ as the basis for the pretty picture they paint in an effort to get the individual to relinquish his birthright, and without carrying his argument to the point of personal effrontery by unnecessary insistence that the reader may have been guilty of misuse of the terms or misunderstood the actual theory of government, convinces him by sheer logic and simple reasoning.

This book is of particular value to the medical profession just now because there is so much agitation for the practice of state medicine in a number of forms. To read the book is to get at once a clear perception of the weaknesses of that kind of a program, and to make the reader absolutely adamant to the specious wiles used by the proponents of that particular brand of social theory. A little thoughtful study of the facts and principles Mr. Cole so definitely sets up will help one very materially in arriving at a sound conclusion concerning both the social aspects of his professional obligations and his individual duties as a good citizen.

Hyperthyroidism, Basal Metabolism and Radiotherapy, H. W. VanAllen, M. D. *Journal of Radiology*, February, 1922.

HYPERTHYROIDISM is a much more common condition than is generally supposed, and in many cases no appreciable enlargement is present even when a plus result is given by the basal metabolism test. Many of these cases are diagnosed as neurasthenia or as disease of the heart muscle.

Too much attention has been focused upon "characteristic symptoms" and too little upon the lesser symptoms of nervousness, unusual perspiration, staring eyes with almost entire absence of winking, mental irritability, and slight but gradual loss of weight. The patient may be almost inviolized and only obscure symptoms be present. It is in such cases that the basal metabolism test is invaluable.

In treating these cases there is a proper dosage which must be observed or the result will be a failure. The author's technique is three and one-half milliamperes, fifteen minutes, four and one-half mm. aluminum filter, eight and one-half in spark gap, sixteen inch distance, six treatments on each side of the neck (twelve treatments in all) given twice per week. This has been used for years with excellent results. Though a few cases have had to be re-treated, no case has had myxoedema and there have been no deaths.

The author believes the basal metabolism test should be given in all cases where a diagnosis of hyperthyroidism is made and in all cases of obscure nervous or suppressed cardiac-muscular disease.

The test should be given while the patient is in a state of mental quietude and physical rest. The home or the laboratory is a better place than the hospital as a rule because a trip to the hospital is for most people a cause of at least some degree of excitement and nervous strain.

After the first test no further one is required until at least a month after the last treatment has been given; the pulse is relied

upon to indicate changes in the condition. Charts are shown to illustrate the accuracy of the pulse as an indication of the effect of treatment.

Roentgenology in Primary Cancer of Lung, Russell D. Carmen, Medical Clinic of North America, September, 1921, p. 307.

PRIMARY cancer of the lung occurs infrequently, but often enough to make its diagnosis of importance. The clinical evidence often fails. The roentgen evidence is of great value.

The growth may arise from:

1. Bronchial epithelium.
2. Bronchial mucous glands.
3. Alveolar epithelium.

Two types are found at autopsy:

1. A mass surrounding a bronchus.
2. A mass invading large portions of the lungs.

Complications often arise and present other pathological conditions:

1. Metastases.
2. Atelectasis.
3. Circulatory stasis.
4. Pneumonia.
5. Pleural effusions.

The roentgenologic types are in the main two:

1. Those which are lobar. These are extensive and may be accompanied by metastasis. This type may at times be milary in origin.

2. Those which are principally hilar. This type is either rounded or irregular and with projections.

The extensive, dense, lobar shadow attended by smaller shadows of metastasis is pathognomonic. All other types require careful interpretation in the light of clinical facts.

E. W. R.

X-Ray Radiotherapy, General Surgery, Cancer of the Breast, Practical Medicine Series, 1921, p. 26.

THE lethal dose for cancer cells has been investigated by Prince and Wood. It requires between five and seven erythema doses of filtered roentgen ray to kill highly malignant sarcoma or carcinoma in man when it is near the surface. Every centimeter of tissue that covers the growth makes an additional amount necessary. Basal cell tumors and lymphosarcoma are much more susceptible to the rays.

F. H. Johnson in the *British Medical Journal* advises roentgenization of pre-operative cancer of the breast in order to weaken the malignant cell and to increase the resistance of the tissue as a whole. It is best to be careful and not overheat, or the cells become stale and lose their resistance. Three weeks is sufficient time to produce a definite effect. His experience is derived from (1) cases of recurrence in the other breast after operation; (2) tumors in old people refusing operation; and (3) where the surgical risk is too great. He finds that pain grows less and the tumor decreases in size. His doses are small and frequent. The tissues are stimulated around the cancer. Post-operative treatment is not contraindicated.

Where operation is contraindicated the good effects are beyond doubt. Pre-operative treatment does not make surgery more difficult. To wait two or three weeks for operation is worth while, for the tumor is improving, and if the technique is good it is not spreading at a depth. Operation should be at the crest of the wave of improvement before the tissue resistance falls.

Recent studies show that a heavier filter of nine minimal allows the dose to be increased to nine minutes without injuring the skin. These rays seem more destructive to cancer

cells and operation can be made in five to ten days after a period of rest.

E. W. R.

The Thyroid. General Surgery. Practical Medical Series, 1921, p. 226. M. J. Hubeny, Chicago.

X-RAY treatment of exophthalmic goiter is not to supercede surgery, but rather it is preferred in certain types because the percentage of cures is as great as following surgery. The earlier the cases are treated, the better the results. Favorable signs are lessening in nervous symptoms, lowering of the pulse rate, and disappearance or improvement in the exophthalmos. The goiter might or might not decrease in size. In ambulatory cases there is no interference with the daily occupation. In marked thyrotoxic cases it is essential to regulate diet, to provide for mental and physical rest. Focal infections should be removed and special attention paid to the teeth. Some of the undesirable and dangerous possibilities were hypothyroidism, tetanoglossitis, and atrophy of the regions treated. Tetanoglossitis is more liable to occur in young women, and also if the filtration is insufficient or if erythema is produced several times.

In discussing this paper, A. J. Ochsner stated that fifteen years ago this treatment was suggested. Many cases improved, but none of them seemed to show permanent improvement. Now the case is different. The technique has been worked out, the physics is understood, and by giving attention to the thymus gland something definite can be done.

E. W. R.

The Influence of Roentgen Rays on Gastric Secretion. Wachter. Strahlentherapie, Vol. XII, No. 2.

THE acid value of the gastric juice is influenced by x-rays. If a sufficient quantity of radiation is applied normal acid values diminish, hyperacidity comes down to normal, and where a stimulative dose is applied conditions of anacidity can be cured.

A. M. P.

Roentgen Therapy in Illy Functioning Gastroenterostomy. Lenk. Wiener Medizin. Wochenschr., 1921, No. 37, p. 451.

BASED on the studies of Wilms that the x-rays have a sedative effect on spasms, the author applied x-rays to illy functioning gastroenterostomies, being of the opinion that only in a small number of the cases the condition is brought about by mechanical obstruction and in the great majority the disturbance is due to spasm. Of the nineteen cases treated with x-rays thirteen gave splendid results, two cases did not respond at all, and upon reoperation were found to be mechanically closed, and a few others are still under observation. The cured cases showed no recurrence of the trouble for over a year. The author suggests that the antispasmodic effect of the x-rays may be responsible for the good results.

The technique is simple: The stomach region is divided into three fields, two anterior and one posterior, each field getting three-fourths erythema dose through five to six mm. aluminum filter.

The author suggests the use of irradiation to prevent the formation of a jejunal ulcer in the gastrojejunal region.

A. M. P.

X-Ray Treatment of Benign Hypertrophy of the Breast. A. Mayer. Strahlentherapie, Vol. XII, No. 1, p. 139.

A CASE of a multipara. The first two pregnancies were normal. During the third pregnancy the left breast became enor-

mously enlarged and the right breast underwent a lesser enlargement. Roentgen treatment was applied. The left breast was divided into four fields, three fields were treated immediately and the fourth field was treated four weeks later. After four weeks the whole breast, which had markedly receded, was treated now in one field, and the breast returned to normal. In a further pregnancy the same breast underwent a similar enlargement, but another course of treatment brought it to a standstill.

A. M. P.

The Roentgen Examination of the Trachea in Diseases of the Thorax. Max Segalizer. Arch. f. Klin. Chir., Vol. CXX, No. 4, p. 967.

STUDYING the trachea in two roentgenograms taken in perpendicular positions to one another, we are able to ascertain all its changes in position and form. Abnormal positions or compression of the trachea are observed in various diseases of the neck, chiefly in tumors of the thyroid or of the lymphatic glands; but they are also common in diseases of the mediastinum as well as of the lungs. The position of the trachea is of moment in differentiating between an aneurism and a mediastinal tumor. Aneurisms usually displace the trachea in a lateral direction, while mediastinal tumors displace it chiefly in an anterior and posterior position. Strong compression of the trachea which is usual in mediastinal tumors occurs but rarely with aneurisms. If in a case of fibrosis of but one lung the trachea is displaced not only laterally, but also brought close to the thoracic wall anteriorly or posteriorly, the case is often mistaken for a cavity on percussion and auscultation.

A. M. P.

Aneurisms of the Aorta and X-Ray Diagnosis. L. Moreau. Arch. D'Elect. Med., Nov., 1921, No. 470, p. 325.

THE author calls attention to the fact that while aneurisms are easily diagnosed clinically, especially aneurisms of the aorta, there is one type of aneurisms, those limited to one part of the circumference of the aorta which are easily diagnosed by the screen, yet clinically are mistaken for some other affection. Three cases of such nature are cited.

The first case was one which was diagnosed clinically as intercostal neuralgia. A thorough physical examination was negative, there was no history of syphilis, and no disturbances in respiration or swallowing were complained of. Yet on roentgenoscopy a large aneurism of the arch and of the descending aorta was revealed. The left border of the aneurismal sac was found projecting by three fingers' breadth from the left heart border. No pulsations were observed. The patient died a few weeks later from a severe hemorrhage, and the roentgen findings were confirmed on autopsy.

The second case was referred to the author for an examination of the stomach because of hematemesis and pain in the epigastrium. Carcinoma of the stomach was suspected. No history of syphilis, negative Wassermann, negative cardiorespiratory anamnesis and examination. A roentgenoscopic examination showed a large fusiform aneurism of the thoracic aorta. A communication of the aneurism with the esophagus explains the hematemesis.

The third case was that of a woman of thirty-eight, suffering severe pains in the dorsal region of the back. On account of tenderness to pressure on several of the spinous processes the case was diagnosed as Pott's disease. Physical examination and history were otherwise negative. A roentgenoscopic examination revealed a definite aneurism of the arch of the aorta.

A. M. P.

X-Ray Treatment of Actinomycosis. Steinkamm. Strahlentherapie, Vol. XII, No. 2, Abstr. Zentralbl. f. Inner. Mediz., 1921, No. 50, p. 966.

IN three cases the author could not prevent the advancement of the disease by the usual treatment with potassium iodide, salvarsan, and operative measures. After the first irradiation there appeared a local reaction, and after repeated irradiations healing began. The boardlike hard swelling decreased and open wounds and fistulae became closed. The author used a spark gap of six.

A. M. P.

Opaque Solution for Pyelography. D. Van Capellen. Nederl. Tijdsch. v. Genesek., 1921, II, p. 1138-40. Abstr. Zentralbl. f. Inn. Mediz., 1921, No. 50, p. 974.

INSTEAD of the solution of sodium bromide the author prepares for his pyelographic work one of sodium iodide. While the sodium bromide is of twenty-five per cent strength and has an osmotic pressure of 13.47 the author's sodium iodide solution is only 13.5 per cent strength and has an osmotic pressure of 3.78 corresponding to the pressure of slightly concentrated urine, almost isotonic. The shadow cast by that solution is by no means inferior to that cast by the bromide or collargol solutions, while the reaction on the part of the patient is insignificant.

A. M. P.

Roentgen Treatment of Trigeminal Neuralgia. E. Pavr. Muench. Med. W. 1921, No. 33, p. 1041.

IN a lengthy discussion of the diagnosis and treatment of trigeminal neuralgia, in which he advises an x-ray examination for misplaced teeth, bone changes, and foreign bodies, the author has the following to say regarding the x-ray treatment of the disease:

"Deep x-ray therapy gives splendid results in cases previously untreated surgically, that is, where no alcohol injection, nor any peripheral extraction were attempted. To our great regret a large number of cases had had such treatment before the roentgen therapy was applied, a fact which is responsible for the reports of failures."

"The roentgen treatment must precede alcohol injection or peripheral extraction. Otherwise, as has been reported by Lenk, and as I had many an opportunity to confirm, the surrounding scar tissue prevents the proper action of the rays on the nerve trunk. It corresponds exactly to the treatment of root pains in metastatic carcinoma of the vertebrae."

A. M. P.

Renal Pneumoradiography. Dr. Paul Rosenstein. Zeitsch. f. Urol., Vol. XV., 1921, No. 11, p. 447.

BY the above term the author designates his procedure of making an extraperitoneal inflation of a small amount of oxygen about the kidney, thus enabling it to be studied at greater detail roentgenologically.

After reviewing the history of air injections for diagnostic purposes the author discusses the technique and purposes of his own newest procedure.

The patient lies on the side opposite the kidney to be examined. After proper aseptic precautions are taken and a local anesthetic is applied, a needle is inserted about five cm. lateral to the first lumbar vertebra. The direction of the needle is slightly medial and upward, and allowed to enter five to six cm. deep. The operator will usually notice that the needle has pierced the musculature and fascia. If blood appears the position should be changed. It is then connected to a bulb and the gas, about one-half to one liter, is inflated under water.

The kidney with a gas mantle around it stands out very distinctly under the screen or on the radiograph. Changes in size, contour, and position, are very easily noted, and by turning the patient the whole kidney is examined. Stones stand out in clear relief.

This method does not come to displace older methods, but to be used where other methods cannot be applied, where cystoscopy cannot be performed.

Renal pneumoradiography affords information on neighboring intraperitoneal organs as well. Even six hundred cc. will be sufficient to raise the diaphragm and give a very distinct outline of the spleen, right sided examination gives valuable information on the gallbladder and liver.

A number of interesting renal pneumoradiograms accompany the paper.

A. M. P.

X-Ray Dermatitis. By Mary L. H. Arnold Snow, M. D. Medical Record, Dec. 3, 1921, p. 981. (Continued from Nov. 26).

THE abstract of Dr. Snow's first paper on this subject was published in the February number of The Journal.

Chronic dermatitis is found chiefly among x-ray operators and is usually the result of a series of exposures. In the less pronounced forms the skin appears chapped and rough, the normal markings destroyed and the folds of the skin at the knuckles are swollen and stiff. It is characterized by hyperkeratosis and telangiectasis may also be present. If of a fourth degree dermatitis the condition may last for years.

An erythema dose requires only suspension of x-ray treatment until it has subsided. In the second, third, and fourth degrees of dermatitis recourse is had to radiant light and heat from a carbon filament lamp and to ultra-violet rays and radium.

The author has made use of radiant light and heat, ultra-violet rays and the gamma rays of radium and considers them all valuable agents in the treatment of x-ray dermatitis. Radium is limited to the treatment of keratoses.

These agents not only inhibit the degenerative process, but they institute regenerative processes and have a systemic effect which raises the patient's resistive powers.

The chemical reactions resulting from the use of these remedial agents is discussed at length, also the technique for their application.

The Technique of Radium Treatment of Carcinoma of the Prostate and Seminal Vesicles. Hugh H. Young, M. D., Baltimore. Surgery, Gynecology and Obstetrics, January, 1922, p. 93.

PASTEAU and Degrais in 1913 presented a method of treatment of carcinoma of the prostate with radium which was introduced into a catheter by means of a long wire attached to a silver tube containing radium. The catheter was introduced into the urethra and left in place for an appropriate length of time.

Since then improved devices have been worked out by means of which radium is introduced through the rectum, urethra, at the vesical neck or through the trigone and base of the bladder to the region of the seminal vesicles.

In a preliminary study a diagram showing the size and consistence of the prostate is made. This is done by means of a diagram of a normal prostate and a rectal examination from which alterations on the chart are then made.

A cytoscopic examination is not made if the x-ray examination shows extreme induration of a portion of the prostate and an

absence of calculus, but if this examination does not result in a clear diagnosis then cystoscopy is performed.

The majority of cases present themselves much too late for radical operation, the disease having progressed well up along the sides of the seminal vesicles and frequently having involved the lower pelvic glands.

Care is exercised to avoid application of radium twice in the same place. The radium is placed in position with the finger in the rectum and is then held in place by means of a cystoscopic clamp. Burns and even pronounced irritation have been entirely eliminated so that it is now possible to give with impunity twenty treatments of one hour each with one hundred milligrams properly screened.

With the introduction of Barringer's needles two of these were employed at a treatment with each needles containing twelve and one-half milligrams. These are inserted through the skin of the perineum (cocainized) into one or both prostatic lobes or even into the carcinomatous mass above the prostatic lobes, or along the lateral wall of the pelvis in the region of the seminal vesicles. These needles are left in place from eighteen to twenty-four hours.

As given at present the treatment consists of one complete series of hourly treatments of one hundred milligrams of radium properly screened and applied with a special applicator alternately twenty times through the rectum, ten times through the urethra, and ten times through the trigone. Twelve and one-half milligrams are given eight times through the perineum. Ulceration is not produced because these regions provide sufficient areas which do not overlap. A recently constructed applicator has shortened the above treatment, as two hundred milligram hours can be given each hour.

With such treatment most cases show an amazing resorption of extreme carcinomatous involvement of the prostate and seminal vesicles and tissue adjacent to them. Disappearance of pain and obstruction, a return to more normal urination and freedom from straining is also secured.

Before treatment the patient should empty the bladder and evacuate the bowels. No anesthesia is necessary for treatment through the rectum, but for treatment through the urethra and bladder four per cent procaine is first injected, and in more painful cases one-sixth grain morphia or opium suppository is given one-half hour before treatment. Sometimes treatment can be given twice a day, but usually only once. Alternation is usually between the urethra, rectum and bladder, picking each time a region not treated previously. A record is kept upon charts and a line drawn each time showing exactly where the radium was applied and the date is indicated on the line pointing to the site of application. Treatments through the perineum are similarly charted.

In a certain proportion of cases, probably ten per cent, obstruction persists and the presence of residual urine and frequency of urination necessitates operative removal of the obstruction, but before prostaticectomy the patient is given as thorough a radium treatment as possible through the rectum, urethra, and bladder, and in most cases the obstruction disappears, but if operation is performed a conservative perineal prostaticectomy with enucleation of the obstructing medium and lateral lobes and careful preservation of the urethra and ejaculatory ducts is carried out.

Remarkable results have been obtained, but the period of time elapsing is too short as yet to give an opinion as to cure, but palliation and lengthened life have at least been secured.

In a paper by Clyde Deming, M. D., Baltimore, published in the same number of Surgery, Gynecology and Obstetrics, Dr. Deming, who is a co-worker with Dr. Young in the Brady Urological Institute of Johns Hopkins Hospital, gives the results of one hundred cases of cancer of the prostate and seminal vesicles treated with radium.

Dr. Deming's conclusions are:

1. Radium gives symptomatic relief and a return to normal urination in seventy-five per cent of these cases.

2. Relieved pain in the back in fifty per cent of the cases suffering with metastases.

3. Irritation from radium can be avoided.

4. At least one thousand milligram hours must be given to produce symptomatic improvement.

5. At least fourteen hundred milligram hours must be given to produce any perceptible change in the tumor mass.

6. At least three thousand milligram hours must be given to produce symptomatic and local results.

7. Four thousand to five thousand milligram hours should be given within a period of six to eight weeks if possible in addition to needle treatments of five hundred to two thousand milligram hours through the perineum.

8. Cases which did not respond to radium did not have sufficient treatment.

9. Large doses must be given in as short a period as possible to produce maximum results.

10. No general systemic reaction has been encountered.

11. Combined extra-glandular and intra-glandular radiations apparently give the most satisfactory results.

12. Thus far there is no actual proof that radium has produced an actual cure for carcinoma of the prostate and seminal vesicles although three cases remained free from symptoms and tumor growth for more than four years and many others upon a rectal examination show a condition of the prostate which does not resemble cancer.

The conclusions reached in a series of thirty-three operative cases are as follows:

1. A combination of radium and surgery offers a possibility for treatment of cancer of the prostate and seminal vesicles.

2. Operation does not diminish the amount of radium necessary to produce good results.

3. Operation does not increase the possibility of hastening metastases.

4. The histological picture is variable.

5. Radium does not act alike in all cancer tissue.

6. Radium has two distinct activities; there is an area of gradual cell destruction and another of necrosis.

7. There are three kinds of cancer of the prostate: (1) scirrhous, (2) adeno-carcinoma, (3) cellular or medullary.

X-Ray Study of Five Hundred Medical Cases for Paranasal Sinus Infection. Rex L. Dively, M. D., St. Joseph, Mo. J. Mississippi M. A., January, 1922, p. 21.

THUROWER quotes from an eminent laryngologist his theory of the causation of sinusitis, which is as follows: "Swelling of the mucous membrane within the nose quite frequently occludes the natural openings. The occlusion is soon followed by an absorption of the contained air, thus creating a vacuum. This leads to transudation of serous fluid into these cavities, as we often find in the middle ear. This fluid soon forms a favorable medium for the development of pathogenic bacteria." The author believes that sinusitis is more often caused by the encroachment of a deviated septum on the normal drainage of the paranasal cells,

Five hundred consecutive cases were studied each receiving a thorough physical and laboratory test as well as a roentgenological examination. The basis upon which they were referred was that of frequent colds, chronic colds, nasal discharge, morning headache, history of nasal operation, deviated septum, obstruction of breathing, pain over the sinuses, nasal deformity, crust formation or dry mucous membranes.

In most cases the examination was made with one plate taken in the forehead-nose or Caldwell position. In doubtful cases the patient was subjected to anterior-posterior roentgenoscopic and latent plates.

The object of the study was to ascertain the percentage of patients in a private consulting practice who showed roentgen evidence of a sinus infection. Many of the patients showing positive roentgen findings of sinusitis gave surprisingly little clinical evidence of it even though under the treatment of a competent laryngologist. In a large percentage of these cases the roentgen findings were proven clinically or by operation.

The study gave the following data:

Number of cases referred for x-ray study, five hundred.

Negative x-ray findings, three hundred and sixty-one.

Some form of positive x-ray findings, one hundred and thirty-nine.

These one hundred and thirty-nine cases are further classified in the original paper.

The history of a number of cases who roentgenologically gave plus symptoms of sinusitis gave sixty-nine per cent with a direct or indirect history of sinus trouble. Examination and history gave twenty-nine per cent diagnosed and forty-eight per cent with strong clinical evidence.

The author's conclusions are:

1. That a roentgen examination of the nasal accessory sinuses should be made in every case of suspected focal infection which gives a history of any of the pathological conditions mentioned in the second paragraph above.

2. Many obscure cases can be diagnosed by the x-ray which would escape notice in clinical examination.

3. Some cases found by the x-ray and not possible to prove clinically give wonderful results upon treatment or after operation.

4. About twenty-seven per cent of patients seen in a private consulting practice have or have had some form of sinus infection.

5. Approximately six per cent of these patients thus seen have an active sinus infection.

Ultra Violet Ray Therapy—Its Application in Nose, Throat and Mouth Affections. Leo C. Donnelly, M. D., Detroit, Mich. *J. Michigan M. S.*, Jan., 1922, p. 23.

THE author has administered in the neighborhood of seven thousand ultra violet ray treatments, and from the experience and data thus obtained submits the following:

Ultra violet rays sterilize infected tissues. Laboratory experiments have proved that the rays destroy germs and also that the red blood cells absorb and conduct the rays to different parts of the body.

"Toxins are broken down in the same way that germs are destroyed, and it is a safe assumption that, after absorption and transmission, as aforesaid, the tendency of the rays and reactions therefrom show:

"Hemoglobin is increased.

"White blood cell content is normalized.

"Blood and lymph flow are both increased.

"Congestion is certainly relieved, cellular tissue is nourished, and elimination of waste products greatly accelerated.

"There is a direct action on the nervous system."

Acute colds may be prevented and chronic colds immediately benefited by ultra violet ray therapy. If treatment is persisted in complete relief results. A very large percentage of cases of chest involvement (pleuritis, whether tubercular or pneumonic, and in empyema show relief from pain.

Nasal and throat diptheria carriers are rendered non-infectious in practically one hundred per cent of cases. In mumps the use of the rays by the author has removed the pain to a marked degree and shortened the duration of the disease. Several cases of osteomyelitis of the jaws have been apparently cured.

Apical abscesses, tooth infections, pyorrhea and kindred mouth infections have been benefited by ultra violet ray treatment. Sterilization of the gums previous to extraction and of the socket after extraction greatly reduces the soreness usually consequent upon these procedures.

In acute sinus infections treatment brings relief of headache, thinning of the pus, and normal ventilation of the sinus with apparent cure. In chronic sinusitis more treatments are required, but permanent benefit is secured.

Acute tonsillitis may be aborted and in any case the duration and severity lessened by ultra violet ray treatment, which will destroy the toxins thrown into the system. The size of hypertrophied tonsils can be reduced—in some cases further treatment by x-ray is, however, required. When operation is necessary pre-operative treatment is an aid. In enlarged cervical lymph glands and tubercular glands the treatment is also recommended, though in some cases x-ray or curetting may be necessary.

In hay fever there is occasionally an apparent cure and frequent benefit from treatment. More perfect control is looked for. In atrophic rhinitis very satisfactory results have been obtained though not complete cures. The changes in metabolism bring about the results in these cases.

In conclusion the author states that the intelligent application of ultra violet rays in general nose and throat infections is always warranted, and through the action of the rays on the blood and cellular tissue a normal local metabolism is established.

Enzyme Mobilization by Means of Roentgen Ray Stimulation. William F. Petersen, M. D., and Clarence Saelhof, M. D., University of Illinois College of Medicine. *Am. J. M. Sc.*, January, 1922, p. 101.

IT is at present a recognized principle in the therapeutic application of photodynamic and radiant agents, including roentgen rays, radium, Finzen and red rays, sunlight, etc., that apart from the direct effect on the exposed tissue, these agents may bring about a distinct systemic alteration.

Musser and Edsall, in studying the effect of roentgen rays on the metabolism of leukemic patients surmised that an acceleration of the proteolytic activity resulted from the roentgen ray treatment. It may be permissible to quote at length from their interesting paper.

"The facts that have just been mentioned demonstrated, we think, that the effect of the roentgen rays is not a direct one, but one that requires response on the part of the individual. To be made specific concerning the processes that are stimulated and accelerated by the roentgen rays, we consider that it is highly probable that the action is chiefly on autolysis. A considerable number of physiological and pathological processes have, with considerable probability, been shown to be due to autolysis, that is, to activities that have the characteristics of ferment-like pro-

cesses and that produce in their course the same classes of substances as those found in the various stages of digestion. The view is now widely accepted that the exudate in pneumonia undergoes resolutions as a result of sudden autolysis, carried out not through bacterial influences, but through the activities of the tissues. Following the general trend of thought and the direction in which the results of recent experimental work pretty generally point, the most natural explanation of the increase in tissue destruction, when this destruction is dependent upon individual body reaction, is that it is due to acceleration of autolytic or autolytic processes. The remarkable suddenness and intensity with which the action of the roentgen rays begins immediately after exposure is more direct evidence in favor of the view that autolysis is influenced."

In a second contribution (Edsall and Pemberton) the effect of roentgen rays on unresolved pneumonia was studied as well as attention directed to possible toxic results that might be related to the effects of the roentgen rays. In these two papers the very definite foundation for the therapeutic application of the rays in stimulation of enzyme activity, thereby influencing pathological processes, was formulated.

Considering the fact that the enzyme mechanism very probably plays a role in such pathological conditions as pneumonia and tuberculous infection, and that even in the non-specific reaction the effect of enzyme mobilization is supposed to be of some importance, we thought it might be of interest to study whether by means of the roentgen ray or other similar agents we could bring about the "shedding" of organ enzymes.

Apart from the mobilization of enzymes the selective stimulation of organs by means of the roentgen ray or related agents is a related field in which therapeutic applications have been reported only in very recent papers. These include the alteration in the coagulation mechanism following raying of the spleen and the effort to increase the function of certain of the glands of internal secretion by means of stimulating doses.

Preliminary experiments were carried out to determine whether variation in enzyme titers occurred in the serum following roentgen ray exposure of the liver, intestinal and splenic area. These experiments were carried out on the dog and from them data were secured on the following points: temperature changes, leukocyte count, differential count, blood coagulation, nitrogen excretion, and enzyme titer.

The conclusions drawn by the authors are quoted below:

1. By means of selective organ stimulation by roentgen rays in moderate dosage it seems possible to influence the serum enzymes to a considerable degree. Such doses act in stimulating a mobilization of various enzymes; large doses lessen the titer of the serum enzymes.

2. Raying the hepatic area (with dogs resulted in a temporary leukocytosis (in eosinophilia) as well as a well defined increase in the titer of protease, peptidase, lipase and diastase in the serum.

3. Raying the intestinal area resulted in a more persistent leukocytosis and a marked mobilization of peptidase; the other enzymes were altered less in proportion.

4. Raying of the splenic area was followed in general by a diminution of the serum enzymes with the exception of he lipase.

5. Alteration in the coagulation time of the blood following raying was not confined to raying of the splenic area, but followed exposure of the other regions as well. No

alterations of complement titer were observed following organ stimulation. The antiferment was usually increased after periods of raying.

Progress and Promise in the New X-Ray Treatment of Cancer. James T. Case, M. D., Battle Creek, Michigan. J. Michigan M. S., January, 1922, p. 28.

The success attendant upon radium therapy led to recognition of the importance of securing more penetrating x-rays, for the gamma rays of radium have a shorter wave length, and are therefore much more penetrating than the shortest wave length x-rays produced up to the time radium was generally accepted for the treatment of deep cancerous growths.

The first voltage used was scarcely four thousand volts, by 1910 a voltage of seventy to eighty thousand was employed, and with the Coolidge tube in 1913 this was raised to one hundred and twenty-five thousand volts. Now, with the very latest of the Coolidge tubes a voltage of two hundred and eighty thousand is employed.

As far back as 1914 reports from Europe told of cures of deep seated cancer, especially of the breast and pelvis, through x-ray or through a combination of x-ray and radium. These reports have continued to be enlarged upon. It is true that several hundreds of hopeless cases with an expectation of only a few months of life have received palliation for a period of several years, and some have been so free from symptoms as to be pronounced cured.

The author has for almost a year now been supervising the treatment of a large number of hopelessly inoperable cases and unprecedented palliation has been experienced with these, but he considers it unfair, unscientific and unwise to make statements regarding the possibility of cure until several years have elapsed. Results, however, are at present most encouraging. Many instances are cited from the Battle Creek Sanitarium Clinic as well as from clinics abroad.

The author and Dr. Kellogg have made it a rule to precede as well as to follow all operations for malignancy with thorough irradiation.

The new treatment is producing prompt and satisfactory results in cases of hyperthyroidism, uterine hemorrhage and obstinate bone infections. Treatment of the tonsils and the prostate is bringing encouraging results.

Important points of technique must be noted. It is vital that the lethal cancer dose be administered at the first attack and within the shortest possible time. The new apparatus greatly facilitates the doing of this. There must be a follow up system with each patient to secure best results. There must be contemporary treatment by various means, mostly physiotherapeutic and dietary. Another paper is promised upon this phase of the treatment.

Benign and Malignant Gastric Ulcers from a Roentgenologic Viewpoint. Russell D. Carman, M. D., Rochester, Minnesota. Am. J. Roentol., December, 1921, p. 695.

The benignity or malignancy of a ulcerous lesion is not always determined by the x-ray. The distinction between typical cancer and typical ulcer is not a difficult one. A typical cancer shows a local diminution, a filling defect of the gastric chamber, while a typical ulcer shows a local expansion, a niche. One is a tumor mass intruding on the gastric lumen, the other an excavation of the gastric wall, but between the two are many gradations, though roentgenologically they must be classified as tumorous or ulcerous.

Experience has proved that most gastric tumors are carcinomatous, therefore, they are diagnosed as cancer. That any ulcer is po-

tentially a cancer is a conclusion difficult to escape, therefore surgical removal of the ulcer is the logical step to take. Only the microscope can be absolutely relied upon for diagnosis here and the roentgenological diagnosis is to some extent empirical.

Some ulcerating cancers have the gross characteristics of both ulcer and cancer. In these cases palpatory manipulation, therefore fluoroscopic examination is indispensable. "Briefly summarized the visualized crater of this ulcer differs from the classic niche-type in three particulars: (1) the crater is not within the wall of the stomach and therefore does not project from the visualized lumen; (2) in profile the crater appears as a meniscus; and (3) it tends to retain its barium content during palpatory maneuvers and is not easily emptied. On the other hand the niche-type of ulcer produces virtually the same roentgenological manifestations whether it is benign or malignant, and any prediction of its probable character based on the roentgen ray findings is hazardous."

When the niche representing the crater is two and one-half centimeters or more in diameter cancer is usually present, though there are occasional exceptions to this.

A perforating ulcer producing an accessory pocket is seldom malignant. "An ulcerating cancer may break through the gastric wall and attach itself to adjacent tissue, but filling defects suggesting the presence of tumor are also likely to be seen."

"A marked filling defect or gross deformity of the gastric outline adjacent to a niche may suggest malignancy. Such deformities, however, are most often due to induration, perforation, adhesions, or spasm accompanying a benign ulcer."

In conclusion—"There are but two varieties of ulcerous lesions which evince any noteworthy roentgenological indications of malignancy. One is the ulcerating cancer with the meniscus-like crater. The other is the niche-type ulcer with an unusually large crater. With these exceptions the examiner cannot venture opinions as to the probable character of ulcers revealed by the roentgen ray, nor should he be expected to do so. Any ulcer which appears to benign microscopically may prove to be malignant microscopically. Cancer may arise in an ulcer which was primarily benign."

The fifteen illustrations accompanying the original paper aid greatly in description.

A Review of Three Years Work and Articles on Pneumoperitoneum. James T. Case, M. D., Surgeon and Director Radiological Department, Battle Creek Sanitarium, Battle Creek, Mich. The American J. Roent., December, 1921, p. 714.

In his introduction Dr. Case states that he finds his position more or less embarrassing. Admitting that pneumoperitoneum marks a milestone in roentgenological progress, being "one of the most strikingly helpful roentgenological means perfected within five years" he asserts that it has inconveniences and dangers which must be admitted and receive serious consideration.

To aid in the study of the question Dr. Case sent out questionnaires to two hundred and twenty-three American workers. One hundred and thirty-one replied, forty-seven of whom stated that they had had no experience, sixty-three that they had had too limited an experience to warrant an expression of opinion.

The remaining twenty-one united in agreeing that aseptic conditions must be duly regarded, certain cardiac and respiratory cases must be excluded, carbon dioxide or a mixture of this and oxygen must be used with the quantity carefully estimated and slowly

injected—and that serious results follow the neglect or disregard of any one of these precautions.

A column is devoted to the discussion of the seemingly unavoidable distress caused by this method. Interstitial emphysema and overdistention it is claimed can be avoided by the use of proper technique.

The dangers from the method are said to be: interstitial puncture (three instances cited), puncture of the omental or mesenteric blood vessels (one case cited), puncture of the dilator ureter, bladder or other abdominal viscus. In connection with the latter danger death is charged in one case to an injection of oxygen into the spleen, and two cases of urinary bladder puncture are mentioned. One case of fatal peritonitis is charged, though this case, it is stated, was probably very susceptible to infection, being a case of advanced carcinoma. However, the author considers the risk of peritonitis to be considerable. One death, perhaps two, is attributed to an embolism. Superficial emphysema is classed as a distressing accident from which, however, no real harm has resulted. Rupture of malignant adhesions is mentioned by a number of twenty-one reporting, but the author does not consider this to be a serious matter. Precipitation of cardiac failure he considers a serious menace and gives a full description of one near fatality from this cause and mentions another. He states: "It is obvious that cases of inefficient myocardium, valvular heart lesion or other cardiovascular weakness should only exceptionally be subjected to this method."

Five deaths are charged and it is stated that while undoubtedly some of these are due to errors in technique, yet they have occurred in some of the foremost medical and surgical clinics of the country, and therefore, it is probable that these risks are unavoidable in pneumoperitoneum.

In regard to indications for pneumoperitoneum, Dr. Case considers it to be definitely indicated in a selected class of cases of obscure abdominal or retroperitoneal conditions, where the careful use of all other clinical means has failed. He strongly advocates the use of the Potter Bucky Diaphragm before resorting to pneumoperitoneum.

In conclusion, he states that the opinions expressed here are not original with him, but gathered from hundreds of sheets of correspondence with men of large experience, however, he states also that he is in agreement with them.

In the discussion following, Dr. Stewart says that while Dr. Case has treated the subject in a fair manner, yet it is to be feared he is distinctly surgical in his tendencies. He observes that death from newer procedures is not so readily accepted as it is from older established methods. He warns against indiscriminate use and gives suggestions on technique. Dr. Case replies to this that it is not his intention to kill the method, reiterates his statement as to its being a milestone in the path of progress and states that he himself expects to go on using it in a limited way, as he considers there is a definite field for its use.

When to Operate and When to Use Radium on Fibroids of the Uterus. George Gellhorn, M. D., St. Louis. Jour. A. M. A., January 28, 1922, p. 259.

RADIO THERAPY and surgery are competing methods in the treatment of uterine fibroids. This does not mean that there is any antagonism between the two—each of them has its definite place in the treatment of these cases. The only question is which of the two is the proper one to apply in the case under consideration. Either indiscriminate radio-

therapy or indiscriminate surgery is against the best interests of the patient.

In general, the principle field for radiotherapy is in women over forty with fibroids not extending above the umbilicus. The ideal fibroid for radiotherapy is the one which is of uniform development, though equally good results are secured in the case of those interstitial fibroids tending to become submucous or subserous.

Patients with marked secondary anemia, with cardiac and renal disease, tuberculosis and other respiratory troubles, high blood pressure, and the excessively stout woman, in other words, the poor surgical risks, should receive radiotherapy. It is useful also for those cases opposed to surgical procedure.

The immediate effects are checking of hemorrhage and shrinkage in the size of the tumor. Most writers maintain that there is no specific effect from either the roentgen rays or radium on the cells of the fibroids, but that the effect is by way of the ovaries. The writer of this paper holds that in addition to this effect through the ovaries, there is a distinct and specific influence of the rays, and to support his theory cites facts from two cases which seem to bear him out in his opinion.

Cases must be properly selected always, as radiotherapy may be not only inefficient, but even harmful if the case has been wrongly diagnosed as fibroid.

Radium alone is superior to the roentgen ray alone, but the ray following radium treatment is often a great aid.

Radium should be inserted within the uterine cavity and remain there on an average long enough to equal twelve hundred milligram hours. Treatment should follow soon after menstruation.

The advantages are summed up as follows: sixty per cent clinical cures, no mortality in expert hands (whereas in surgery even the best records show a mortality of three to five per cent), the morbidity following treatment is insignificant, radiotherapy is less expensive than surgery and allows a quick resumption of daily activities.

Surgical treatment is indicated in all tumors extending above the umbilicus, and in all large pedunculated, subserous or submucous fibroids, for here radiotherapy might produce a necrosis of the tumor. Cervical fibroids, suppurating necrotic or gangrenous tumors and those undergoing cystic or calcareous degeneration, and fibroids complicated by ovarian tumors or tubal infection should be reserved for surgery. Unsexing may be avoided in surgery, but cannot be in radiotherapy, therefore, in women under forty surgery is the method of choice.

There is a group concerning which there is still discussion as to the method to be employed. Rapidly growing fibroids suspected of sarcomatous degeneration may be operated or receive radiotherapy, but if the latter is used the sarcoma dose must be given. Fibroids are sometimes found associated with carcinoma of the body of the uterus. In these cases the author prefers a panhysterectomy, but if asthenia or lesions of other organs exists, radiotherapy may be used. It is of vital importance to establish the presence of a corpus cancer before treatment is instituted, and this should be done by a preliminary curettage, which, indeed, should precede any intrauterine radium application, even in cases in which there is no suspicion of malignancy. If it is still desired to use the radium the customary dose of twelve hundred milligram hours should be increased to three thousand milligram hours and the treatment repeated within a few weeks.

Fibroids encroaching heavily upon the bladder or rectum and interfering with their function the author would remove as quickly as possible by surgery, but many experienced workers advise an attempt, at least, with radium or roentgen rays.

The Management of Certain Types of Malignancies. Jackson W. Landham, M. D., Atlanta, Ga. J. M. A. Georgia, January, 1922, p. 1.

RESULTS obtained by the combined use of the x-ray, radium, electro-coagulation and fulguration in connection with surgery or used alone in inoperable cases have justified these measures in the management of all types in malignancies. Both the growth and the patient must be carefully studied before deciding on the method of treatment.

Basal cell epithelioma occurs more frequently in men and is found in the nodular form, as an ulcerated area, or as a scaly lesion. Over ninety-six per cent of these are located above the clavicle. Better cosmetic effects and as high a percentage of cures as with surgery lead the author to prefer other methods than surgery in these cases.

His technique is as follows: (1) Destroy inflammatory and hypertrophied tissue by fulguration and thus close the lymphatics having a direct communication with the lesion. (2) Irradiate the lesion with the roentgen ray or radium, protecting the surrounding normal tissue by means of a sheet of lead one-sixteenth of an inch thick, which has been perforated to conform to the size of the growth to be treated, the area receiving a pure erythema dose. Two mm. of aluminum with the x-ray or five-tenths mm. of brass with radium is sufficient filtration. (3) Treat regional lymphatics with the x-ray to prevent the possibility of metastases, using deep therapy, heavy filtration and high voltage.

Epithelioma of the mucous membrane of the mouth are highly malignant and show an early tendency to metastasize and the mortality rate is very high. Most cases referred to the radiologist are referred from the surgeon because inoperable. Fulguration, massive doses of radium and intensive x-ray therapy over the growth and the adjacent lymphatics are required.

In inoperable, post-operative and recurrent cases of carcinoma of the breast and in metastases of these cases the roentgen ray is the agent of choice. The technique used is nine and one-half inch spark gap, five milliamperes current, ten inch skin target distance and not less than six mm. aluminum as filters. The entire surface should be treated through small portals of entry, eight by ten centimeters, with nine to fifteen minutes exposure. Electro-coagulation and radium should supplement the roentgen ray treatment.

Dr. William J. Mayo is quoted as authority for the statement that post-operative and pre-operative treatment by the roentgen ray is most desirable. "By properly combining radiotherapy with surgery we can increase operability, lower mortality and increase the percentage of cures." Operation should not be delayed after radiotherapy because of the comparatively short period of increased cell vulnerability and the fact that the subsequent connective tissue formation will interfere with surgery. The author states that three weeks after ante-operative treatment is the proper time for operation.

Cancer of the cervix, when seen by the surgeon or the gynecologist, is practically always inoperable. A review of the literature shows that roentgen rays and radium are invaluable here.

In lymphosarcoma the roentgen ray is more effective than radium and preferable to surgery.

Treatment of Goiter. C. L. Hoag, M. D., San Francisco, California State J. Med., January, 1922, p. 6.

IN the treatment of goiter the pendulum has swung from medicine to surgery, and now over toward radiotherapy. The author makes the criticism that much of the treatment is carried on in a perfunctory way, without proper choice of cases and without a knowledge of the general principles essential to intelligent choice of therapeutic measures. Too many who have little experience in even general therapy are giving treatment for this malady.

Diagnosis of thyroid disease is only the first step—it is just as necessary to recognize clearly the various forms of thyroid enlargement as to distinguish between different forms of intestinal parasites.

For practical purposes the classification given below meets all requirements:

GOITER

Atoxic	{ 1 Simple hypertrophy, adolescent goiter. 2 Colloid, calcified or cystic. 3 Simple adenoma.
Toxic	{ 1 Toxic adenoma. 2 Hyperplastic (exophthalmic).
Malignant	{ 1 Carcinoma. 2 Sarcoma, etc.

In well developed cases it is easy to determine the classification of the goiter, but many border line cases give only mild symptoms and a large goiter may be deficient in thyroid secretion while a barely perceptible gland often is producing an extensive degree of hyperthyroidism.

Since the thyroid secretion seems to be the principal regulator of the metabolic processes of the body an accurate estimate of its activity is secured by determining the basal metabolism in goiter patients. Many diseases influence the metabolic rate, but the influence of goiter is most striking.

In the Crile and Mayo clinics radical operation is not done in toxic cases until the basal metabolism is less than plus fifty per cent. Medical treatment, ligation of the superior thyroid arteries and x-ray are used until this point is reached, and even then the time of the operation must be determined by the phase for each indicated.

The author believes x-ray or radium therapy is indicated in simple hyperplasia and hyperplastic goiters only, and contra-indicated in colloid, cystic, nodular and adenomatous types. Treatment of goiter is essentially surgical, medical treatment. Roentgenotherapy and radiotherapy are sometimes curative and are often helpful in decreasing thyroid activity and in preparing the patient for operation.

The X-Ray Diagnosis of Gastric and Duodenal Ulcer. L. R. Hess, M. D., Hamilton, Canada. Canadian M. A. J., Dec., 1921, p. 914.

THE interpretation of x-ray findings on the screen, in terms of pathology, requires more skill, judgment and experience than almost any other diagnostic procedure. Inexperience and mistaken technique are the most fruitful sources of error in diagnosis.

Additions to or subtractions from the normal gastric or intestinal lumen, as seen on the plate or screen, form the basis of roentgenological diagnosis of gastric and duodenal ulcers.

The author's technique consists of fluoroscopic examination with barium, palpation, and a number of serial plates, two to ten, some of which may be made in oblique and some in lateral position. After five hours

another examination is made and twenty-four hours after the first examination the third examination is made.

These ulcers vary in size from that of a split pea to an area two and one-half inches or more in diameter, and are usually situated near the pylorus and nearly always are found involving the lesser curvature or the posterior wall. Loss of tissue first involves the mucosa and later spreads to the deeper layers. Scar tissue results with the ultimate deformity of the gastric wall, the demonstration of which forms the basis of differentiation between the two lesions.

A small bud-like projection from the main shadow represents the actual ulcer crater and this niche is pathognomic of penetrating gastric ulcer. The accessory pocket is demonstrated as a sac or pouch protruding from one-fourth to one inch or more inside the stomach proper, retaining its contents often after the stomach is empty and having a narrow neck or isthmus connecting with the stomach.

Other more or less indirect signs are the following: incisura (indentation of the greater curvature opposite the ulcer), hour-glass stomach, pressure tender spot and lessened mobility. Malignancy is always suspected when the ulcer crater is large.

Except for the fact that gastric ulcers are larger, more prone to scar tissue and adhesions and more likely to become malignant, there is no pathological difference between them and duodenal ulcers.

The indirect signs in duodenal ulcer are: the accessory pocket, gastric hyperperistalsis, gastric hypermotility with rapid emptying, pressure tender point, and a residue after six hours.

The value of these indirect signs is small when compared to visualizing on the screen or serial plates a fixed and constant irregularity of the duodenal bulb, which is normally a constant entity. A deformity of the duodenum may be produced by adhesions or by spasms, but these filling defects are not constant in action.

The Present Position of the Treatment of Carcinoma of the Cervix. William Fletcher Shaw, M. D. Brit. M. J., December 31, 1921, p. 1101.

WERTHEIM'S hysterectomy and the discovery of the effect of radium on the lesion has brought a greatly improved prognosis in cancer of the cervix, but results are yet far from satisfactory.

The public should be educated to realize that hemorrhage is a symptom requiring investigation, and every physician should recognize that an examination in such cases is a duty not to be delayed. Early investigation would greatly aid in results of treatment.

Under old methods of treatment cancer of the cervix was divided into two groups and a vaginal hysterectomy was performed in early cases, and in the others too far advanced for this, palliation was sought through scraping and cauterizing the cervix. With only rare exceptions recurrences were the order.

Wertheim's hysterectomy was a great advance in treatment, though with this the mortality is still very high, due largely to the fact that many cases are very far advanced before aid is sought.

Radium therapy was the next great step in the treatment of these lesions. The writer is not over-enthusiastic in regard to the present results obtainable with radium, but enthusiastic enough to predict that it will ultimately be relied upon solely in the treatment of these cases.

The Absolute Value of Surgery, Radium and X-Rays in Cancer Therapy. Isaac Levin, M. D., Clinical Professor of Cancer Research, New York University and Bellevue Hospital Medical College, New York City. The Urologic and Cutaneous Review, January, 1922, p. 5.

SURGERY, radium and x-ray therapy constitute today the total of all known methods of combating cancer. Over-enthusiasm or unwarranted pessimism concerning any one form of treatment interferes with true scientific progress and is to be deplored and discouraged. To find the true evaluation of each method and perhaps a correlation of them is of the greatest import. After thirty-five years participation in the work the author states that while the cancer victim today has undeniably far greater chances of recovery than ever before, yet undue enthusiasm does only harm to his cause. In cancer therapy immediate results must always be discounted a few years later.

Surgery, while meeting with some degree of success, has not solved the cancer problem. A comparative analysis of vital statistics and cancer statistics shows that in the hands of different surgeons the highest percentage of all cancer cases of a community which can be cured by surgical treatment is 15.25 per cent and the lowest 4.15 per cent, or in all probably less than ten per cent.

From a study of the mechanism of the action of radiation in radiotherapy it is evident that radiotherapy is theoretically superior to surgery, inasmuch as it may destroy or inhibit malignant tumor tissue without injury or removal of the adjacent normal tissues. This surgery cannot do.

Much has been done by x-ray alone and much by radium alone. The advantage of radium over x-ray lies in the fact that the same local effect can be obtained by it without the general reaction so frequent and so severe in x-ray therapy.

The quotient of the depth dosage in roentgenotherapy can only be improved by the addition of the secondary and scattered radiations, which form within the tissues. The larger the portal of entry the greater the quantity of the secondary radiations, and to obtain the necessary quantity in the depth a large field must be used.

The newest apparatus and methods make it possible to send a certain fairly well defined quantity of radiations into deeply seated malignant tumors. Nevertheless a great many of the deductions made by the originators of these methods are too sweeping and do not bear scientific, biological, and clinical analysis. Biological behavior of a cell cannot be translated into an arithmetical equation and certain assertions as to cure are premature.

From a clinical survey it is concluded that "though the newest methods of x-ray therapy represent great progress and must supersede all the previous methods, x-ray therapy alone is not a correct method of cancer therapy and is undoubtedly not as efficient as surgery alone or radium therapy alone."

Both radium and the x-rays exert a truly specific selective action on cancer tissue and biologically they present the nearest approach to a specific therapeutic measure. The limitations of both agents are due mainly to the size and location of the tumors. Further progress in cancer therapy must be looked for in the development of correct methods of combination of the three therapeutic measures.

Radium Technique in Treating Cancer of the Esophagus. C. W. Hanford, M. D., Consulting Radium Therapist, Cook County Hospital, Chicago, Ill. Jour. A. M. A., January 7, 1922, p. 10.

IN cancer of the esophagus the fluoroscope will show stricture if this exists, but tells nothing as to the thickness of the walls and very little as to the extent of the lesion upward and downward. Judging from necropsies the author believes the lesion usually extends from one to two inches, though some may possibly extend farther. The varying thickness of the wall of the canal adds difficulties.

However, with only the fluoroscope, dilators and the esophagoscope as aids in radiotherapy of this disease, good results are being accomplished in a number of cases. The canal can be kept open and a gastrostomy avoided.

There are five requisites for the proper placement of radium in the esophagus, namely: A knowledge of the location and physical peculiarities of the tumor and the resulting stricture, especially as to location, extent and direction of stenosis; a means of effective and non-traumatizing canalization of the cancerous stricture; a mechanical means of maintaining the radium in direct contact with the tumor; a ready means of frequent observation as to the position of the radium during the period of the treatment; and lastly a careful selection as to dose, filtration and frequency of treatment.

The location of the malignancy may be determined by (a) the fluoroscope after bismuth or barium, (b) sounding with olivary bodies, and (c) esophagography. Sometimes all three must be used, though the author does not favor the esophagography.

The ingenious device of Sippy, made of silk thread, wire and olivary bodies is used to accomplish canalization and there are several ways of maintaining the radium in contact with the tumor, one of which is described.

A roentgenogram, taken after the carrier is in position, and fluoroscopic examination, using fluid bismuth, is made six hours after the carrier has been placed.

The author bases his dosage upon empiricism, fifty milligrams being selected with an exposure from eight to ten hours. Starting at the lower end of the canal the radium is raised at the end of eight hours to the next area.

The results are not all that can be hoped for, but they are of value. Out of fifteen cases the author has seeming cures in four, and all patients were benefited. Dysphagia was relieved and pain kept at bay for a time. Subsequent treatment helps in many cases, and this treatment the author gives in from three to four weeks after the first.

In conclusion, the author states that since there is a percentage of cures in a disease formerly always fatal, and since life is prolonged and palliation secured in the majority of cases without gastrostomy, the radiotherapy of this type of malignancy is invaluable.

Pathological Classification of Thyroid Gland Diseases with Radium Treatment in Toxic Goiter. R. E. Loucks, M. D., Detroit, Michigan. Am. J. Roentgenol., December, 1921, p. 754.

DISEASES of certain glands or organs must be classified accurately as to the pathological condition present; whether it is acute, subacute, or chronic is important.

In diseases of the thyroid there are three important general classifications with subgroups of each. They are:

1. Inflammations—
 - (a) Acute purulent thyroiditis (rare).
 - (b) Tuberculous of the thyroid.
 - (c) Diffuse interstitial thyroiditis.
 - (d) Interstitial thyroiditis as in pellagra.
2. Tumors—
 - (a) Carcinoma.
 - (b) Carcinoma sarcomatodes.

- (c) Sarcoma.
3. Dystrophies.
 - (a) Colloid retention hyperplasia.
 1. Colloid goiter (diffuse).
 2. Circumscribed colloid adenomata (cystic).
 - (b) Proliferating type.
 1. Adenoma.
 2. Fetal adenoma.
 3. Adenoma with toxic changes.
 4. Primary exophthalmic goiter as a selective type.

For clinical classification of hypo- and hyperthyroidism the following from Plummer is given:

1. Hypothyroidism—
 - (a) Cretinism.
 - (b) Myxedema.
2. Hypertyroidism—
 - (a) Thyrotoxic adenoma.
 - (b) Exophthalmic goiter.
3. Non-toxic enlargements—
 - (a) Adenomas—non-toxic
 - (b) Adolescent goiter.
 - (c) Colloid goiter.

Toxic adenoma produces no sudden exacerbation and the sequence of symptoms is different from the exophthalmic in type. The development of the disease is gradual and the symptoms cumulative.

In exophthalmic goiter there may or may not be enlargement, toxic symptoms are mild until about the eighth month, when what is called the crisis occurs; there follows improvement with fairly constant symptoms until the end of the second year, when a secondary crisis occurs, after which there may be rapid deterioration and death or prolonged invalidism.

Note is made of the relation between oxygen intake and hyperactivity of the thyroid and the basal metabolism test is explained. Probably more than ninety per cent of the cases showing an increase in the rate of metabolism are due to hyperthyroidism.

Fear, shock, and violent emotions may precipitate hyperactivity, and focal infections from the tonsils, adenoids, duodenal and typhoid ulcers are apparent causes. Gastric disturbances, general ptosis of the abdominal viscera, also hypo and hyperactivity of other endocrines at the time of puberty, pregnancy, and the menopause are associated with it.

The symptoms are: a florid blotchy skin, tachycardia without organic heart disease, profuse sweating of the palms of the hands and soles of the feet, longitudinal striae of the nails, a choking or aching pain above the sterno-clavicular articulation, bulging eyes for two or more years, pale, muddy complexion, edema of the extremities, pulse rate of one hundred and forty with irregularity, high blood pressure, emaciation with a history of rapid loss of weight, strong apex impact with pulsation of the intercostal muscles over the heart, cardiac dullness increased with the accentuation of last sound or both sounds of the heart, apex beat one hundred and eighty with one hundred and twenty recorded at radial artery, urinary symptoms of a failing heart muscle, high basal metabolic rate, persistent diarrhea, cerebral symptoms and the presence of acidosis, a positive Wassermann.

In beginning treatment, unless diarrhea is present, saline elimination is suggested. Rest in bed, non-protein diet, ice bag over thyroid gland and precordia, alkalines internally and alkaline sponge baths are employed. Strontium bromide may be tried, quinine, hydrobromide, ergot, ergotine and sodium cacodylate. If after two weeks there are still decided evidences of thyroid toxemia the decision between surgery, x-ray and radium must be made.

The author believes radium is the treatment of choice, as results are more promising than with x-ray, and it is portable, less exciting, more easily controlled and does not pro-

duce a sudden toxemia. Atkins of Toronto, Canada, is cited for a report of one hundred cases so treated with wonderful results.

The histories of five cases of the author are given at length, and the following conclusions are drawn:

1. Where the degeneration of the heart and kidneys has not become permanent the systolic blood pressure is lowered in those cases with high blood pressure.
2. The blood pressure is raised in those where compensation is re-established.
3. In those with a metabolic rate around eighty, it was lowered for the first two weeks, raised for the third and fourth weeks, and then gradually decreased for the next few months.
4. In those with a metabolic rate above one hundred, with broken compensation, it gradually decreased after the third week.
5. In many very active cases the metabolic rate was found to be normal after three months.
6. Metabolism being the standard of toxic activity, the rate of measurement will verify clinical findings, prove results of treatment and show a physiological indication for future measures.

The discussion by Drs. W. H. B. Aikens, George E. Pfahler, and Albert Soland bore out Dr. Loucks in all which had been given above though Dr. Pfahler expressed himself as being cautiously fearful of using too much radium upon first application and afraid to use two hundred milligrams on one side and then on the other, as Dr. Loucks had done. Also Dr. Pfahler emphasized the importance of getting rid of focal infection, mentioning the teeth, sinuses, gallbladder and appendix particularly.

The Treatment of Cancer of the Rectum by Radium. Douglas Quick, M. D., New York City. *Am. J. Roentgenol.*, December, 1921, p. 746.

THE therapeutic work accomplished during the last few years are not yet of real value, since enough time has not elapsed to judge of final results and also because the technique is changing and improving so rapidly that nothing final is yet established. Experience is encouraging, however.

In regard to surgery it may be said that a fair resume of its statistics gives the following results: "At least thirty per cent of the cases are inoperable when first seen by the surgeon. Of the operable group the immediate mortality is about sixteen per cent. The cases found clinically free from disease at the end of a three year period average below twenty per cent, although a few selected groups average over thirty per cent. An average of fourteen per cent of all cases coming to the surgeon are free from disease at the end of three years, and we know, of course, that this rate is lower each succeeding year."

The response of adeno-carcinoma and of epidermoid carcinoma to radium has been studied in other parts of the body, and since most rectal malignancies are of the one type or the other we can say from this knowledge that the rectal treatment with radium is a problem of technique.

To give an idea of what may reasonably be expected in rectal treatment, a review of the work accomplished during the past four years in the Memorial Hospital is given.

One hundred and sixty-one cases were treated—practically all very far advanced. Dr. Quick expresses the opinion that about forty per cent of these would have been better off had they not received treatment, as there comes a time in the course of malignancy when physical agents are of no avail.

A large number have been benefited from

one to three years; others are still improving and hope of complete regression is held out to some. By improvement is meant inhibition of growth, decreased size in some cases, with fibrosis resulting in a localized growth. Decreased size is followed by relief from constipation. Bleeding and discharge of mucus are alleviated and pain is very much decreased. Septic absorption is lessened and consequently there is a gain in weight and strength and a general feeling of well being. A few patients are enabled to again take up their daily work.

The bulk of infiltrating growth low down in the rectum frequently involving the sphincter gave trouble until buried emanation and surface radiatio followed by local excision was adopted with encouraging results.

An exploratory laparotomy is felt to be justifiable in cases where the local growth presents possibilities of complete regression following the use of radium. This conclusion was reached by way of the many cases which after a short period of improvement then presented distant metastases. Metastases are found in a surprising number of cases when the primary lesion is small and the condition not suspected. A laparotomy saves many of these patients a needless amount of suffering from the after effects of what in their case would be worse than useless treatment.

A colostomy is considered very objectionable and is advised only when the application of radium is facilitated thereby and when the opening can be closed later on.

The writer has gradually changed his technique from applying filtered radium internally only to a combination of buried emanation, filtered radium internally and externally, and if necessary, surgical exposure to make the application.

Irritation of the normal rectal mucosa has added to the difficulty of treating rectal cancer.

In 1917 the use of interstitial radium emanation brought about very marked improvement in results, for both beta and gamma radiation can be used and the radiation can be distributed throughout the growth and left there for continuous radiation for a few weeks if necessary. The tubes may be inserted without anesthesia, but short gas and oxygen anesthesia is favored by the author.

At first with the use of buried emanation the internal use of filtered radium was largely discontinued, but this was found to be a mistake and its use resumed.

Rectal carcinoma must not only be treated from within, but from every available angle. Radium packs are made use of in following out this principle of treatment and results obtained are justifying it.

In conclusion—though the classification given below is vague and will be changed with changing technique, some system must be adhered to in formulating a plan of treatment. There are three groups. Group one includes all cases for whom a reasonable hope for complete regression can be entertained. In this group radium in largest possible doses through all available channels is necessary. An external laparotomy is advisable in most of these cases. With these hopeful cases the attendant discomfort of treatment must not deter one from its administration. In certain cases, especially in bulky growths involving the small sphincter surgery may be employed. A temporary colostomy may be necessary for a few.

Group two includes those advanced cases for whom a reasonable hope of palliation exists. With these patients their comfort is the first consideration. Discharge, bleeding, pain and obstruction can often be relieved by surface application, but this should not be pushed to the point of discomfort, and buried

emanation with these patients is rarely warranted. A colostomy may be a necessity, but the decision should rest with the patient after all facts have been made known to him.

Hopelessly advanced cases for whom the physical agents hold out no chance of relief, constitute those in the third group. For them hygienic measures and medical relief are the only resource, though occasionally a colostomy may be of some benefit. It is hoped that medical education and improved technique will bring a decrease in the number found in this class, but its entire disappearance is too much to hope for.

In the discussion of this paper by Drs. Pancoast, Pfahler, Bowing, Loucks and Quick, early diagnosis, exploratory laparotomy, electro-coagulation, after-treatment and diet were emphasized as important aids in handling rectal malignancy.

Intensive X-Ray Therapy as Seen Practiced in the Clinics of Europe. Samuel Stern, M. D., Radiotherapist to Mr. Sinai Hospital, New York City. Am. J. Roent., December, 1921, p. 741.

THE author gives a resume of his impressions gained during a recent visit to various clinics in Germany.

He finds great differences of opinion—in fact, unanimity exists on but two essentials of intensive x-ray therapy, namely; the necessity of an apparatus to deliver at least two hundred thousand volts and the employment of heavy filters.

Descriptions are given of the technique used at Frankfurt Frauen Clinic for mammary carcinoma, uterine carcinoma, myomas, sarcoma of the uterus, rectal carcinomas, carcinoma of the vulva, and of the bladder; at Freiburg Department of Internal Medicine the technique for pulmonary tuberculosis and Basedow's Disease; at Freiburg Surgical Clinic the technique for fractures, tuberculosis of the bones and joints, late rachitis and prophylactic treatment.

As stated, the difference of opinion is very great, the most serious difference being as to when an erythema dose may be repeated, the variation being from one month to six months.

Operations on all cases of breast and uterine cases is practically discontinued and all workers are emphatic on the non-surgical treatment of any type of sarcoma. In other malignant growths, however, the results are not so satisfactory.

The tubes in general use at present are either the Suderhahre or the Coolidge type of tube, with an occasional Lillienthal tube. None of them will stand more than a two and one-half ma. at two hundred kv. and are rarely pushed to more than two and two-tenths ma. For the past two months (Sept., 1921), they have been making tubes of the Coolidge type that will stand four ma., but these as yet have not been properly tested out for durability. Dr. Coolidge here is trying out a tube which will carry eight ma. at two hundred kv.

In a number of clinics they are even now installing machines capable of delivering up to three hundred kv. and are merely waiting for tubes to be perfected.

As an example of cases seen, one is cited who had been treated four years previously for inoperable carcinoma of the uterus, involving the fundus and both parametrium, with deep seated pelvic and inguinal glands. The uterus is at the present time freely movable with no sign of any thickening in any part of the pelvis. The patient has gained fifty pounds and looks the picture of health.

Roentgenological Studies of the Injected Kidneys. W. K. Lim, M. D., Dept. of Research, Jefferson Clinic, Detroit, Mich. Am. J. Roentgenol., Dec., 1921, p. 704.

A BRIEF and very logical review of the main points in the embryology and anatomy of the nephridial system is first given.

The specimens used for this roentgen study were freshly removed kidneys of adults, children, and fetu from autopsy and surgical cases; freshly removed kidneys of animals, which as far as could be ascertained, were normal; kidneys injected *in situ* soon after death; pathological kidneys injected before and after surgical intervention. There were fifty-five kidney specimens taken from these four sets; illustrations and descriptions of two of each of these sets are given.

The conclusions reached from the study so far are: First, that work upon the normal kidneys of adults, infants and fetu reveals that there is always a dissimilarity in capacity, size and shape of the pelvis and the number of the calyces, not only between two different individuals, but also between the two kidneys from the same subject. Second, that the super-imposition of the shadow of one or more calyces upon the other portion of the calyces and pelvis will throw a shadow which will often resemble a stone in the pelvis. Again, if the cup-like terminal depression of the minor calyx happens to be a very deep one, it will produce a ring-like shadow of less density than the main shadow and this may be mistaken for a renal calculus. Very frequently, also, the main renal vessels cross the upper portion of the pelvis, the isthmus of the major calyx and the minor calyx. The crossing of these vessels especially if they are in a state of distention will bring about a distorted and abnormal shadow, isolating either the minor and major calyx from the main body of the pelvis or producing a partial obliteration or constriction of the isthmus.

A description is given of the preparation and injection of the specimens for study and also the essential points for roentgenographing the specimens.

Unexplained Constitutional Symptoms Caused by a Foreign Body in the Tissues. Max J. Schroeder, M. D., New York. Medical Record, January 14, 1922, p. 63.

THIS is a case history of a child fifteen months old who swallowed several safety pins linked together. Repeated gastro-intestinal roentgenograms failed to reveal the presence of any foreign body and finally the child was dismissed without diagnosis.

From that time on the child, who had formerly always been healthy and rosy, grew sleepless, appetite failed, an obnoxious breath developed, and about fourteen months from the time the pins had been swallowed she became sick and the physician called pronounced it to be a case of anterior poliomyelitis.

A short time after this child came under the care of the author, and upon the examination of the oral cavity a slight elevation of the posterior wall of the pharynx a little above the natural position of the soft palate was noted. Upon closer scrutiny a glistening object was noticed, and upon incision of the elevation three medium sized safety pins, rusty and greenish in color were withdrawn and followed by a rush of greenish colored pus. The cavity was given the ordinary care and healed within about three weeks and the child became once more normal in appearance and health.

The point is made that while the pins may have been swallowed in the first case, that they later, perhaps in vomiting, were lodged in the pharynx and that in all cases

of search for foreign bodies supposedly swallowed it is necessary to x-ray the head as well as the gastro-intestinal tract if the body is not first located in this tract. The author believes that the anterior-poliomyelitis arose from the continuity of the infection, or, at least, that it is plausible to believe that it did.

Medical Electricity, Roentgen Rays and Radium, with a Practical Chapter on Phototherapy. By Sinclair Toussy, M. D., consulting surgeon to St. Bartholomew's Clinic, New York City. Third edition. Thoroughly revised and greatly enlarged. Octavo of 1,337 pages with 861 practical illustrations, sixteen in colors. Philadelphia and London. W. B. Saunders Company, 1921. Cloth, \$10.00 net.

THE first twenty-four pages of this comprehensive work give a simple and lucid exposition of the nature of electricity.

Static electricity is then taken up, the first few pages explain insulation and conduction, describe the Leyden jar and discuss the nature of the electric spark. About twenty pages are given over to the description of static machines, their construction, size, care, and operation. A short exposition of electric units and of the sources of static electricity and tabulation of the physical effects is followed by ten pages devoted to methods of therapeutic application, and about the same space to a discussion of dosage.

About five times the space devoted to static electricity is then given to dynamic electricity—its nature, source, detection and measurement of currents all thoroughly discussed and explained. About thirty pages of this section deal with the alternating current. Electrolysis and the thermal effect of the electric current are elucidated.

Following this section twenty-five pages treat of electricity in animals and plants. Electric currents in the skin, the current of rest, the galvanic muscular wave, the Porret-phenomenon, currents of action, voltage and amperage of bio-electric currents, the wave of negative variation, local currents of action, electrotonus and the cause of animal electricity are taken up.

Next is a description of the physiologic effects of electricity upon microorganisms, vertebrates and their tissues.

The section dealing with electropathology contains reports of various fatalities from electrical apparatus, describes the pathological effects produced and explains the electro-physiology of these accidents and lays down precautions to observe.

Materials for electrodes are briefly described.

In the section on electro-diagnosis the motor points of the body are illustrated by eight plates—normal and abnormal electric reactions, resistance of the body, laws of nerve stimulation, application of condenser discharge, and diagnosis of the eye, ear and neuritis are the topics here discussed.

About eight pages following this section are taken up with medication by electrolysis, galvanic, faradic and sinusoidal electrotherapy and electrotherapy in diseases of the nervous system, and a few of the special features of war injuries—these are constantly kept in mind throughout the sections on therapeutics and diagnosis.

High frequency currents, their description, application and effects are given one hundred pages.

The theory of ionization of gases and the passage of electricity through a vacuum are briefly treated, but sufficiently to give an intelligible idea to the reader.

The chapter on phototherapy (thirty pages) gives the principles of this method, describes the apparatus and recounts the chemic, bio-

chemic, and physiologic effects of the ultra violet ray.

The history, properties and production of the x-rays take up the first one hundred pages of this section. The next three hundred pages deal with fluoroscopy and radiography, about two-thirds of this is given to specific technique and interpretation. The physiologic effects of the x-ray are discussed and precautions given. About ninety pages are given to roentgenotherapy in all its phases.

The history of radium, its cost, variations in radioactivity, the chemic and radiographic effects of radium, the theory of radioactivity, the physiologic effects upon microorganisms, plants and animals, and pathologic effects of radium are discussed in the first half of this section on radium and the last twenty pages of the section are given to radiotherapy under the headings of apparatus, dosage, lupus, skin disease, malignant disease, puncture for carcinoma, use of normal saline solution exposed to radiation, radium in eye disease, uterine fibroids, nervous diseases, tonic effect upon the heart, and substitutes for radium.

The index and table of contents are excellent.

The author is to be congratulated upon his achievement of a truly scientific book, so written that the intelligent layman with a general knowledge of the natural sciences can read it with enlightenment, though without full comprehension. To the roentgenologist not so thoroughly grounded in the physics of electricity as he would like to be and should be, but who has not yet forgotten or given up studious habits, this work is an invaluable aid—one feels more like saying an indispensable one.

Radio-Diagnosis of Pleuro-Pulmonary Affections. By F. Barjon. Translated by James Albert Honeij, M. D., Assistant Professor of Medicine, in Charge of Radiology, Yale School of Medicine. Cloth, octavo, 175 pages and index. Eighty illustrations, fifty-three of which are radiograms and twenty-seven diagrams. New Haven and New York City. Yale University Press, 1918, \$3.00.

THE author, while enthusiastic in regard to radio-diagnosis very strongly insists that a final and complete diagnosis is not within the province of radioscopes and urges close collaboration between physician and radiologist in these cases.

The classic and fundamental positions are described and procedures for complete as well as detached examinations are outlined.

Three chapters, sixty pages, take up the pathology and diagnostic interpretation of the pleurae under the following headings: pleurisy of the large cavity, circumscribed and encysted pleurisy, and pneumothorax.

The bronchi are taken up under the headings: foreign bodies, bronchial affections, tracheo-bronchial adenopathy.

The lungs are treated under the topics: vascular processes, acute infections, pulmonary processes (pneumonia, broncho-pneumonia,

pneumonic abscesses, gangrene), chronic pulmonary processes, and pulmonary tuberculosis to which about half of this section of fifty pages is given over. Lung tumors are discussed under cancer of the lung and pleurae, hydatid cysts of the lung and dermoid cysts of the thorax.

The last section (fifteen pages) is a chapter on penetrating wounds of the thorax by war projectiles. Clinical study, radiological study, indications and contra-indications for operation are discussed.

This book, first published in 1918, therefore containing the very latest information of all details of this phase of radio-diagnosis, is an excellent work on the fundamentals of the subject. We wish that some one of our American authorities might be spurred to produce something as admirable upon the same subject.

Roentgen Interpretation. A Manual for Students and Practitioners. By George W. Holmes, M. D., Roentgenologist to the Massachusetts General Hospital and Instructor in Roentgenology, Harvard Medical School, and Howard E. Ruggles, M. D., Roentgenologist to the University of California Hospital and Clinical Professor of Roentgenology, University of California Medical School. Second Edition. Thoroughly revised. Octavo, 228 pages, 184 engravings. Philadelphia and New York. Lea and Febiger, 1921. Cloth, \$3.25.

THE second edition of this book is a further justification of the authors' purpose, as declared in the first, namely, to provide a "practical aid to those in search of a working knowledge of roentgen interpretation.

The roentgenologist's need of a thorough knowledge of anatomy and of clinical and surgical pathology is stressed and guiding axioms for diagnosis given.

The part played by calcifications, areas of increased density in spongy bone, warts, fibromata, metallic salts, gas and defective plates in producing misleading shadows is concisely given, are also anatomical variations.

The fundamental points in the diagnosis of fractures and dislocations are discussed, and under bone pathology the specific topics are osteomyelitis, tuberculosis, syphilis, typhoid, bone tumors and diseases of nutrition, the latter two are treated in specific detail. A tabulation of the findings in the more common bone lesions is given for use in differential diagnosis.

A separate chapter is given to the pathology of the skull and its contents, one to joints, tendons and bursae, one to the heart and lungs, one to the gastro-intestinal tract and one to the genito-urinary tract.

Fifteen of the one hundred and eighty-four illustrations are diagrammatic drawings to illustrate stomach pathology. The bibliographies appended at the end of each chapter give more than two hundred references to the literature, mostly American and British.

X-Rays and Radium in the Treatment of Diseases of the Skin. By George Miller MacKee, M. D., Assistant Professor of Dermatology and Syphilology, College of Physicians and Surgeons, Columbia University, Consulting Dermatologist and Syphilologist, St. Vincent's Hospital, New York City. Octavo, 602 pages, 250 engravings, 22 charts. Philadelphia and New York City. Lea and Febiger, 1921. Cloth, \$9.00.

THE need of thorough training, modern knowledge and equipment in present day roentgenological practice is noted in the opening chapter, and the fact that the pioneers in this field deserve a credit and homage sometimes forgotten by those who now enjoy the results of their labor, is dwelt upon at some length.

Following the historical sketch the electron theory of matter and the physics of the x-ray tube and rays are briefly expounded. The radio-active elements and their radiations are likewise reviewed.

The description, operation, and evaluation of x-ray apparatus is gone into in some detail throughout seventy-five pages. A chapter is given to pastilles and one to arithmetical computation of x-ray dosage. Roentgen ray technique, both filtered and unfiltered, and radium technique are thoroughly discussed in their general aspects.

The chemical, biochemical and biological effects of the roentgen rays and radium is the subject of a short but interesting chapter, tantalizingly suggestive of ultimate solution; the following chapter describes briefly the general effects of the roentgen ray and of radium upon the animal organs and tissues.

Two long chapters go into the detail of the clinical effects of these agents upon the normal skin, and the pathological histology of radiodermatitis. A general consideration of their action on pathological tissues follows in a later chapter. Idiosyncrasy is also given a chapter.

The last half of the book deals with the therapeutics of the following diseases and lesions: diseases due to pyogenic organisms, those due to fungi, eczema, psoriasis, lichen planus, pruritus, prurigo, diseases of the appendages, hypertrichosis, diseases of the hematopoietic system, those due (supposedly) to the tubercle bacillus, verrucous lesions and eruptions, nevi and congenital keratoderma, benign and malignant growths and miscellaneous affections.

The last chapter is of interest from the medico-legal point of view and contains suggestions of value to the practitioner inexperienced in this sometimes unpleasant aspect of his professional life.

This book is one which should be thoroughly mastered by every one practicing radiotherapy. The technique described is safe and satisfactory, and the fundamentals are discussed in such a way that all may obtain from it a good knowledge of the underlying principles of the radiotherapy of skin lesions.





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The Physical Foundations of Deep Therapy*

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THIS paper deals with the methods of deep therapy which have been developed by Professor Dessauer in his institution for the physical foundation of medicine in the Frankfort University.

Seventeen years ago, Dessauer investigated the physical and technical side of the problems of deep therapy. The problem was this: Is it possible to produce the same effect in the deeper parts of the human body in a similar manner as that on the surface of the skin? The solution to this question soon led to the formation of Dessauer's law of homogeneous radiation, which includes both a qualitative and quantitative homogeneity. By qualitative homogeneity, Dessauer means a mixture of rays, consisting of wave components which do not materially change when penetrating into the deeper parts. The idea which called forth the qualitative homogeneity is the following: It is not known, whether the same amount of absorbed soft or hard rays have the same or different biologic effect on tissue. Not only is it necessary to apply the same kind or quality of rays, but also the same amount or quantity, if we wish to study their biologic effects on healthy and diseased cells. In order to produce a quantitative homogeneity, that is, an absorption of the same amount of rays in different depths of tissue, very high penetrative rays are required. At the time of Dessauer's first research, it was not possible to produce sufficiently penetrating rays, as apparatus was not constructed which would deliver continuously the high voltages. Dessauer's technical research work led to the construction of apparatus which will deliver the required voltages of two to three hundred thousand and above. The development of the Coolidge tube has given us tubes which will stand very high voltages. They also possess the further advantage of constantly producing the required rays, which may be varied at will in

their quality as well as quantity. With the advent of the apparatus and tubes the means had been obtained for the development of an efficient deep therapy.

The biologic studies had at this time shown that diseased and healthy tissues react differently to the rays. Weffeler was the first to study the question of "sensibility," Kroenig, Friedrich, Bumm, and Warnekros, Serts and Wintz, have made many biological and physical investigations. Thereby, the intensities or energies of radiation were determined that were necessary for the production of a therapeutic effect in the deep parts of the body. The question of the distribution of the intensity of the rays within the interior of the human body was not solved. Dessauer was the first to point out that when raying with homogeneous radiations, the problem could be very much simplified by estimating not the absorbed, but the transmitted energy for the study of the biologic effect. When determining the transmitted energy, the physical laws of absorption and scattered radiation, as well as many other facts must be considered.

Among these factors may be mentioned the size of the field. Using a large field, an additional amount of energy is produced through scattered radiation. The energy is not only greater in the area within the ray beam, but also in the parts adjacent to it.

The distribution of the intensity within the body was studied by Dessauer and his co-workers. As water has the same qualities of absorption as human tissue, the experiments were made in a water phantom. By photographic methods, accurate values for the distribution of the radiation were obtained. The investigations were made for three variable factors, namely, focus-skin distances of thirty, forty, fifty, sixty and seventy centimeters; fields from six by eight centimeters to the largest practicable, and voltages measured at the tube terminals of one hundred and fifty, one hundred and sixty, one hundred and eighty, and two hundred kilovolts crest value, filtered

through 0.5 to 1.3 millimeters copper and one millimeter aluminum, the choice of the thickness of the filter depending on the voltage.

The quality of the radiation can be stated more exactly by the total absorption factor W , which may be very accurately ascertained by means of an electroscope and known absorption filters. The total absorption factor W for water, used in these experiments was 0.14 to 0.18. With the three variable factors given—distance, size and field and quality of ray, the distribution of the rays in the radiated medium was studied. The results were published in a number of articles and collected in a number of tables and charts ready for use. A copy of this work will soon be published in English by Rebman and Company in New York.

I will now show you some of the charts. The intensity on the surface of the skin is assumed to be one hundred per cent, and those within the deeper parts of the body are expressed in percentage of the surface intensity. The curves connect all points having the same intensity and show the distribution of intensities within the body. Fig. 1.

The curves reveal unexpected results. For instance, parts which are protected from the direct rays receive quite a large amount of radiation through scattering from the radiated one. Within four to five centimeters beyond the periphery of the radiation beam, half the intensity is still active. If the experimental measures are compared with the values calculated from the laws of absorption, these intensities are almost six times as large as the calculated values obtained within the interior of the body, if large fields and very penetrating rays are used. The effect of the scattered radiation is more marked in the deeper parts, whereas the first few centimeters receive only a small amount of scattered rays. (Fig. 2, Fig. 3, and Fig. 4.)

With these charts the specialist is enabled to formulate an exact plan for treatment. Let us consider as an example a carcinoma of the cervix of the

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

uterus, with an invasion of the parametria and metastases in the lymph glands along the bony pelvic walls. The medical man will ask the scientist to produce within a certain zone at a certain point, a known intensity of rays. According to the facts given by Friedrich, Kroenig, Sertz and Wintz, the location of the carcinoma must receive about the same intensity which would produce upon the skin an erythema dose, placed arbitrarily at a value of one hundred. In our case a rather extended zone must receive this intensity, for it would be absolutely insufficient if only a part of the carcinoma were to receive the full energy. In a case that we have studied in 1920, the whole zone from the tuberosity of the ischium to the navel had to be radiated uniformly. Fig. 5 and Fig. 6.

How may such a problem be satisfactorily solved? With a single field it is not possible, to produce a uniform trans-radiation with a hundred point energy in the deeper parts and one must try to radiate the particular zone from several entrances. Generally, four fields are found sufficient, the frontal, dorsal and two lateral. The frontal and dorsal fields may be very large, up to eighteen by twenty-four centimeters. The lateral fields must be smaller, corresponding to the smaller surfaces of the lateral aspects of the pelvis. To ascertain what intensities will be furnished through each of the four fields, we must make a cross-section of the body in line with the center of the disease or of the zone to be radiated. This cross-section is drawn in natural size upon tracing paper. The latter is placed upon the charts in such a manner that the surface is in line with the line one hundred, and so that the central ray passes through the center of the carcinoma. A few points should be marked on the cross-section in order to ascertain the energy obtained at these points in the interior. Thus, we can calculate whether the carcinoma is receiving sufficient homogeneous intensity throughout or not. It is also necessary to determine the intensities which the skin and healthy tissues receive. A table may now be prepared in which the horizontal row carries the values at the points marked, and the vertical row the volume at the point of entrance. Such a scheme is shown in Fig. 7. The summation of the values in the columns gives the total at the given points obtained through each field. It can be seen that the intensity of the radiation which has passed through the body must be known, as it might amount to a value higher than permissible. In this instance it is fifty per cent too high. To eliminate all danger of a burn, the time of radiation in this case must be

reduced by one-third. Thereby, the intensities are changed, as enumerated in the last column. The method demonstrates the advantage of large sized fields and the possibility of reducing the time-duration of the application of the rays to the lowest permissible amount. Should certain points on the surface or in the interior receive too large or too small an intensity, a shortening or an increase of the time-duration of the application in a certain field may reduce the danger.

It is not always easy to find the proper method of distribution if the patient is very fat or very lean. The diseased zone may be very deep in the first, or the skin surface may be too small in the last instance. The question arises, how under such circumstances, a greater effect in the deeper parts may be produced? There are different ways which are illustrated in the following cross-section. (Fig. 8.) You will see that the first method would not lead to the desired result and that the intensity of one hundred on the surface decreases towards the center and again increases to ninety-five per cent towards the end. If a higher voltage is chosen, it is possible to gain a very much better intensity in the interior, as you will see from the next figure, Fig. 9. The latest deep therapy apparatus and tubes permit the production of a still better ray and make it possible to obtain a still larger quantity of rays on the interior, or, in other words, offer a very much larger protection of the skin.

A similar gain of intensity in the deeper parts can be gained by increasing the focus-skin-distance and a corresponding increase in the time of exposure. The result of such a method is shown in the next figure, Fig. 10.

Another method to raise the effect in the deeper parts is the employment of a superposed material which possesses the same qualities of absorption and scattering as living tissue. Such materials are wax, paraffin or bags filled with water. By their use the drop of intensity towards the interior is retarded and the improvement of the dose in the deeper parts is increased, as is shown in the drawing, Fig. 11.

Finally, the application of radium might be advantageously employed to increase the amount of radiation in the cancer organ and thus supply the deficiency in the roentgen radiation, as shown in Fig. 12 and Fig. 13.

To study the action of radiations from radium, the institute has constructed similar charts as for x-rays, based on the same biologic unit, namely, the erythema skin dose. A combination of these charts permits the combined use of radium and roentgen rays. The fol-

lowing drawing shows such a combination, Fig. 14.

You see that any number of methods will solve practically any problem, but the best method, from the physical point of view, is the interposition of a layer of wax, paraffin or water. The irregular form of the human body in other regions may be made into a square form with even surfaces and the calculations and charts applied. This method is most successful in uterine carcinoma. The central location of the tumor affords the best opportunity for a uniform or homogeneous distribution of intensity, as shown in Fig. 15.

The solution of the problem of treatment is different when the carcinoma is near the surface, when it can only be attacked from one side and therefore can not be homogeneously radiated. In such a case, for instance, a carcinoma on the tongue, or of the oesophagus, the conditions for treatment are very unfavorable. The medical man may ask, what is to be done under these circumstances? The scientist answers: "Produce for these parts similar topographical conditions as are found in a uterine cancer. For this purpose, layers of the above mentioned materials, wax, for instance, should surround the jaws and neck. In the case of carcinoma of the tongue, the mouth may be filled with paste, as the air contained in the cavities of the mouth has different values of absorption than tissue.

In cases of carcinoma of the breast and axillary glands, the superposing of water bags may eliminate the irregular surface of the body and thereby the possibility is given of applying the radiation through four fields of entry. By such accessory methods, it may be possible to overcome the difficulties existing in such irregular regions of the body. Thereby such cancers may also be subjected to the same method of treatment as described.

Finally, I wish to state that it is possible by physical methods to ascertain in advance the quality of rays furnished by any apparatus, and also the time required to produce an erythema skin dose with such a ray and the penetration attained.

For calibrating transformers and tubes I have built a small portable standardized electroscope with which I can find the intensity of the rays, their quality and homogeneity, the time duration to obtain the erythema skin dose, the penetrability of the ray and the proper filtration.

SUMMARY

I have explained Dessauer's method of deep therapy, which is undoubtedly physically correct. As a scientist, I can not discuss the medical results obtained

THE PHYSICAL FOUNDATIONS OF DEEP THERAPY—BACHEM

Distribution of Intensity under Conditions as follows: Coolidge tube with tungsten or platinum anode. Voltage on tube approximately 150 K.V. Filtration 0.5 Cu. plus 1 Al. Focus-skin distance 30 cm. Fields radiated 5.7 x 7.6 cm. M. Water 0.180. Cross Section 3.7 cm.

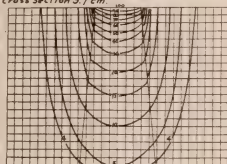


FIG. 1

Distribution of Intensity under Conditions as follows: Coolidge tube with tungsten or platinum anode. Voltage on tube approximately 150 K.V. Filtration 1.3 Cu. plus 1 Al. Focus-skin distance 30 cm. Fields radiated 5.7 x 7.6 cm. M. Water 0.166. Cross Section 5.7 cm.

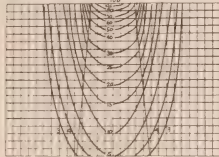


FIG. 2

Distribution of Intensity under conditions as follows: Coolidge tube with tungsten or platinum anode. Voltage on tube approximately 150 K.V. Filtration 0.5 Cu. plus 1 Al. Focus-skin distance 30 cm. Fields radiated 18 x 24 cm. M. Water 0.180. Cross Section 18 cm.

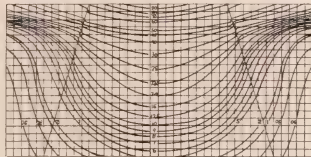


FIG. 3

Distribution of Intensity under Conditions as follows: Coolidge tube with tungsten or platinum anode. Voltage on tube 162.5 K.V. Filtration 0.5 Cu. plus 1 Al. Focus-skin distance 30 cm. Fields radiated 18 x 24 cm. M. Water 0.166. Cross Section 18 cm.

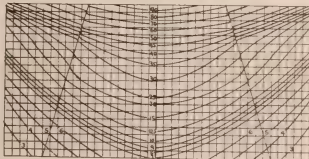


FIG. 4

Cross Section in 10 cm. depth thru large pyramid. Voltage on tube approximately 200 K.V. Filtration 1.3 Cu. plus 1 Al. Focus-skin distance 30 cm. Field radiated 18 x 24 cm. M. Water 0.140.

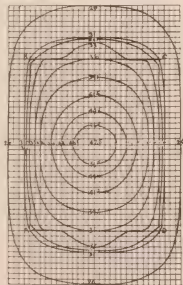
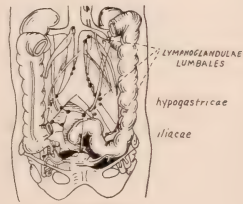


FIG. 5



Anatomical Field for Uterus Carcinoma Treatment
FIG. 6

Radiation Table for Uterus Carcinoma.

Fields	Points				
	A	B	1	2	3
Front	100	30	48	75	40
back	22	30	48	33	41
right	18	4	27	24	9
left	18	100	27	24	53
Total	158	164	150	156	143
% Dytan	106	109	100	104	95

← FIG. 7

2 fields 24 x 18 cm. Frontal-back
2 fields 24 x 9 cm. Right-left
Focus-skin distance 30 cm. M. water 0.149

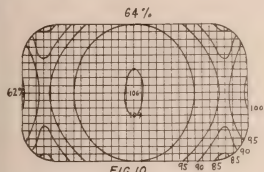


FIG. 10

Cross Section of radiated Volume.
Fields: Front, back 24 x 18 cm²; right, left, 24 x 9 cm².
Focus-skin distance 30 cm.
Absorption coefficient 0.149

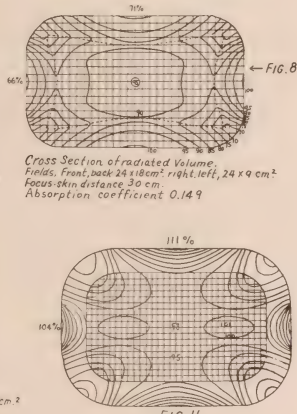


FIG. 11

Radiation with 4 cm. Paraffin layer.
Fields: Front-back 24 x 18 cm²; right-left 24 x 9 cm².
Focus-paraffin distance 30 cm.
Absorption coefficient 0.149

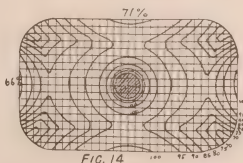


FIG. 14

Combined Roentgen-ray-radium treatment.
Fields: Front-back 24 x 18 cm²; right, left 24 x 9 cm².
Focus-skin distance 30 cm.
Absorption coefficient 0.149 Mg-Ra-El-St. 1000

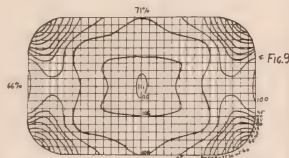


FIG. 9

Cross Section of Radiated Volume.
Fields: Front-back 24 x 18 cm²; right-left 24 x 9 cm².
Focus-skin distance 30 cm.
Absorption Coefficient 0.140

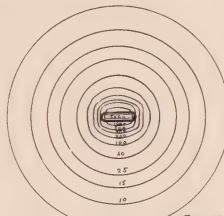


FIG. 12

Erythema dose in 3 cm. space in water or tissue produced by 5000 Mg-Ra-El. hrs. All figures are reduced to 100 = Erythema dose or 5000 Mg-Ra-El. hrs.

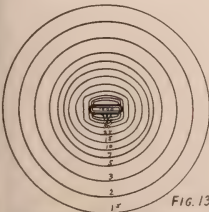


FIG. 13

Erythema dose in 3 cm. space in water or tissue produced by 5000 Mg-Ra-El. hrs. All figures are reduced to 100 = Erythema dose or 5000 Mg-Ra-El. hrs.

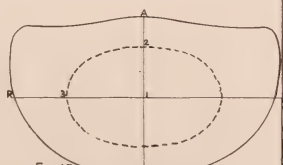


FIG. 15

Cross Section thru Abdomen.

with this method. It enables one to select the proper radiation and determine the actual intensity obtained in the deeper parts. The multiple, small field method of x-ray therapy must be replaced by the large field method to prevent the loss of the therapeutically important scattered radiation which is totally sacrificed in the old method. When you employ the new methods, work with extreme care and accuracy and you will attain still better results than in the past.

DISCUSSION

DR. HENRY SCHMITZ (*Chicago*): I did not expect to discuss the paper. The one point that Professor Dessauer brings out is the fact of the homogeneity of the radiation. It must be qualitative as well as quantitative. In other words, the ray which strikes the surface of the body should be the same kind of ray that enters and passes through the body. It must be of the same quantity on the surface as it should be in the interior. This result can be obtained only by choosing the proper focal skin distance, the proper voltlation and the proper size of field and filter for that voltlation, the number of fields and sizes of fields which will bring into the interior of the body radiation which may degenerate the carcinoma.

The set of charts worked out by Professor Dessauer, based on these factors, gives us equal intensity curves at various percentages, starting with one hundred at the skin and going to ninety, eighty, seventy, sixty, etc. We know it because a certain intensity takes within the body. Within the radiation field there seems to be a variation in the depth. In other words, within the center, or four or five centimeters from the center, the radiation seems to be horizontal. As it reaches the periphery, it seems to rise. The radiation is strongest in the center and decreases slowly as the periphery of the radiation shows.

In the large radiation of twenty centimeters there is a difference at times of thirty per cent of the center of the radiation field. If we were treating carcinoma that had a transverse diameter of twenty centimeters, then we would probably obtain intensity of one hundred in the center. At the periphery the intensity would be only seventy per cent at the same height. It will not do any harm, as far as the patient is concerned. The intensity of seventy will not cause the carcinoma to disappear rapidly.

In the radiation field, that is, in the adjacent parts of the tissue, there is still a scattered radiation. This is quite large, as we were told by Dr. Bachem. That is very important in therapy. Intensity in a certain instance might be

from twenty to twenty-five per cent. If we add radiation from a lateral field to this radiation, we must get this twenty-five per cent in order not to use an intensity which might cause harm to the tissues.

I am sure you have all found cases of an erythema skin dose given through multiple fields and you wondered why necrosis beneath the skin occurred. There was an overlapping between the radiation beams in the interior of the body.

It also shows another thing and that is the importance of correct work in deep radiation therapy. In the first place, the selection of the proper variable factors. It makes a lot of difference whether you have a focal skin distance of thirty centimeters or one of fifty or sixty-five. It makes a great deal of difference whether you use a small field or a large field. It makes a difference whether you use a filter adopted for that kind of voltage. If it is too weak, you get a different intensity of quality of radiation. If it is too thick a filter, you are working very economically because a good deal of radiation is lost which would be of benefit to your patient if you were using proper filter.

Dr. Bachem has invented an electroscope. With this he is enabled to determine intensity of the radiation without reference to the kilovoltage which might be used in that machine. You can determine the proper filter to be used in that kind of radiation.

In the third place, the penetration of the radiation, and fourth, the time duration of the application. If this instrument actually does what Dr. Bachem claims for it, and I have no reason to doubt it, it would be a great advance in our armamentarium for deep roentgen therapy. I believe I have talked long enough. Thank you. (Applause.)

DR. PARISEAU: Mr. President, if you will allow me, I will try to condense all that I have gathered from talking in every corner with everybody. The impression I have gathered from all of this talk is that there is a certain amount of pessimism. People are all up in the air as to the value of the method, whether it is a step forward, whether we are able to standardize, etc. I should say that the general impression is dismal. I think we must not leave with that impression.

I must reiterate that everything that has been done in deep therapy is a distinct step forward. The contribution of our German colleagues is a step forward. We know more what we are doing than what we did.

I said in my paper that there were ample physical reasons justifying the use of higher voltages. It seems that these drafts show it. There is no reason

to believe that one kind of ray, one wave length, is better for cancer than another. That is not proved. There are physical reasons for knowing when we have jumped from a ten inch spark to a fifteen or twenty. We are working under better conditions. We can do it with a ten inch spark the same, but as stressed by these drafts, we can do it with considerable more danger to the skin. Therefore, that part is certainly a distinct step forward.

The drafts are absolutely exact. I have no reason for doubting they are right, but I cannot be tempted to borrow them for my own use. The other drafts have to be made for other machines or conditions. I will try to explain why with a very short sketch.

We will take two widely different cases of a man who is working with a coil and a man who is working with a transformer. In one case his voltage curve may be of this type, eliminating the inverse. In the other case it may be a curve of that type, because they have the same peak. Our tendency is to conclude they will let through exactly the same kind of rays. Of course, you know that this part of the sign curve will let through rays that are rather too long, but I could filter them out. Because you know you could filter them out, you may be inclined to think you have the same peak, duplicated, the same quality of waves. You have not.

Professor Duane has shown us in a most conclusive manner that there is no comparison possible for equal voltages between the quality of rays—the bunch delivered by transformer and the bunch delivered with his sustained voltage apparatus—that is, smoothing out the pulsations with condensers. Why? How are these rays produced? A certain number of electrons are torn off of the cathode as it is bombarded. The wave length will be proportional to the speed of these electrons and the speed of the electrons is proportionate to the voltage impressed through the tube. If we have a sustained high voltage, we are shooting out electrons continually at the same speed. They keep on running to the target, throwing out wave lengths that are more homogeneous.

If we shoot out voltage that reaches the same peak but sign voltage, the lower part will throw out sluggish electrons. They will start towards the cathode. Immediately, after electrons with greater speed are supposed to be thrown towards the cathode. Do you think they will reach it with sufficient speed?

Suppose I start two men walking toward that target and tell Williams to run for it. What would happen? He would strike against these men. He

might be able to push them over from what I can see of him, but you will admit his efficiency to reach the target would be diminished.

If Professor Bachem is using a certain type of apparatus with a certain form of wave, they are calibrating on their own apparatus and giving us drafts absolutely reliable for their own. We could not borrow them and use them immediately in a Wappler, Victor or another machine that has a different physiognomy as far as the waves are concerned.

We must imitate our German confreres in the thorough work they have done. They have shown us how to do it in every step, but we must apply these methods of investigation to whatever apparatus we have here. It is either a question of buying their apparatus and using their drafts or buying our own and having somebody else, the Schmitz and others, make drafts for us. That is, I consider, the point.

It brings me to one thing: People have been talking to us about service, offering us service suggestions. These service suggestions and others contain a good deal of advertisement for certain machines and a good deal of abstracts from Kyle and others. When we had read all of this we came to a last paragraph that told us that this was no good to us at all. That was the truth. It might have been said at the start. It was true. The only service that would be of any good to us would be that of Professor Schmitz. Dr. Erskine, who has done good work on it, should try out the particular type of machine with a spark length under different conditions.

They have not stressed the great factor of the geometrical form of the patient. Dr. Bachem stressed it. If you take a thin woman, so thin you could feel her pulse by her abdominal aorta you should not expect to use the same quantity of radiation as for a big, fat woman. I hope you see exactly the great importance of this, building up the patient into geometrical form. If that is done for us by the people who are in a position to do it—I am not for the moment, and you are not, many of you—if that is done for us in a thorough manner by the people in a position to do it, we have made a step forward.

We have not defined our dosage, although we have defined it better by opening Dr. Ullmann's suggestion. It is understood that the percentage of the peak that is taken in our machines has much to do with the quality of the output.

What would be of service to us? As I see it, here in America, where as I have said before the conditions are different from those in Germany, if a

man interested in research, a man having the sacred fire in him, a physicist, would (for a salary given to him by subscription of all radiologists throughout the country) pass from one city to another and visit and advise the different men—that would be a service. He could say that on a certain date he would be in Montreal and answer a certain question of interest to me. I would say, perhaps, that I would like to know the wave form of my current and he would say: "Here, sir, is your wave form. There are too many harmonics on this line. You must expect discrepancies. You, Doctor, in Quebec, have a rather good sign wave."

"What is the output of my apparatus? Is my millimeter right?" Out comes the calibration standard and the millimeter is tested there with a resistance. "Yes, it is right," or "No, it is wrong." "What is the quality of my ray with this given machine pushed to its limit? What kind of a filter should I use? Is six enough?" "Yes, six is enough." "Is eight too much?" "Eight would be wasteful. If you use eight you have passed the practical homogeneous point and wasted your energy."

The electroscope I consider a very, very precious thing. I know that Professor Esaire Eolimeau in France has a similar apparatus. We have gathered that Professor Wintz uses it over-time.

After reading part of the work of Professor Wintz, I am in a position to say he has done much of his work with a water phantom and says himself with calibrated tubes and given standards he uses arithmetical computations as we do. When he uses ionization chamber he estimates error at five per cent.

I would ask that you all think of this idea and if somebody finds it practicable, if this society finds that it can be done, there is not one of us here present who would not give \$25 annually for the kind of service we would like. I am sure we have in this room men who would pay and overpay the salary and traveling expenses of a physicist willing to help us. (Applause.)

CHARLES GOOSMANN (*Cincinnati*): Mr. President, Ladies and Gentlemen: I do not think any of you appreciate any more than I do the brilliancy of Dr. Pariseau's mind and the brilliant ideas he is giving us, but in spite of that I will say I am using these Dessauer charts carefully and without any expectation of going the limit immediately.

I believe they are accurate for this reason: Dessauer made them on the transformer, on the Viva Transformer. We are using them on the two hundred kilovolt transformer, but even if the difference were as Dr. Pariseau says, the difference, for instance, between the

wave of a coil and the wave of a transformer, it would not, in my opinion, detract from the value of the chart because after we filter out the soft rays and the medium rays, after we filter with a half millimeter of copper which is the least I think that we will use, we are practically using only the peak, only the crest of the wave.

I know that ten years ago Guilleminot showed that ten millimeters of aluminum gave a homogeneous radiation. He did not use the transformer as I recall it. He used a coil. He was working at a time when we knew very little about what x-ray really was. We knew nothing about it before Lowrie's work. He showed that ten millimeters of aluminum gave practically a homogeneous ray. That is, the absorption ray was practically a straight line. That means that the rays are homogeneous for practical purposes. We find that a half millimeter of copper is homogeneous for practical purposes and is equivalent practically to ten millimeters of aluminum.

In ten years we have learned that the man's work ten years ago was practically as accurate as ours is today.

Kroenig and Friedrick have gone further and said that a whole millimeter of copper is more nearly homogeneous, more perfectly homogeneous. They went further and instead of using absorption for their tests, they used spectrum. They found after filtration through one millimeter of copper, instead of a half, the rays were anything but homogeneous. In other words, true homogeneity is impossible for us to achieve. We will never get down to a single wave length.

As I say, the French research workers showed ten years ago that that was approximately obtained with ten millimeters of aluminum. The Germans show it was a half millimeter of copper. In other words, they were correct in the first place. At the time that Friedrick and Kroenig changed the technique, if instead of changing portals of entry, twenty, forty or sixty, they had kept the old Albers-Schoenberg technique of long target distance, long target entry and added aluminum filtration, they would have done more for roentgen therapy than they did. They put us back somewhat. We are coming back to the Albers-Schoenberg technique.

He used thirty-eight arbitrarily because he could not afford to spend the whole day on the treatment. He used a large portal of entry. The tubes did not emit sufficient ray. With the Coolidge tube we can get the ray. If we will use an Albers-Schoenberg technique with the Guilleminot filtration, we have the modern German technique.

I believe there is a great deal in the new technique, from the little experience any of us have had, and I believe it so much that I borrowed some money to bet on it.

The important thing that I have taken away from this meeting is a conviction, a very determined conviction that I am going to do some funny stunts on the next carcinoma of the breast. I have a patient doing nicely with radium needles, heavily filtered x-rays. If she gets any more treatment, it will be like this: I will make an "L" shaped piece of wood, a little right angled piece of wood, and get either some water bags, preferably made out of animal bladders rather than rubber, or else I will get somebody to make a nice batch of dough or paraffin and mold it under that so I have a perfectly three-sided chest and I will give a treatment from the front, from behind and from the side, using the Des-sauer chart for determining the dosage. I believe we are going to get better results than by simply shooting it on the surface.

If Dr. Pariseau is right, I am going to be in trouble in the near future. I am going to use these slowly, carefully, very carefully, and keep my fingers crossed during the whole performance.

I believe here is the whole secret of the thing. If we consider that Des-sauer's charts are made for a purely relative purpose—he does not say what is your surface dose, he says "If your surface dose is one hundred per cent," then your deep dose is so much under the other conditions. I am pretty sure from my talk with him in Washington and from the reading of the literature, we are safe in reading these charts if we do it carefully. (Applause.)

DR. SCHMITZ: Dr. Bachem and I have discussed one point concerning the effect of absorption, rates of intensities, using different sign ways, etc. He wishes to make the following statement: By determining the total absorption factor known, he places at 0.14 to 0.18, the loss of absorption of the primary radiation as well as that of the scattered radiations taken into consideration.

Any radiation that has, for instance, the 0.14 will give us the same intensi-

ties. Absorption curves that have been determined for a current that possesses a total absorption factor of 0.14 intensity currents will hold good. It makes no difference whether you use a continuous sign wave or these interrupted waves or whatever they are.

Another statement is this: Ten millimeters of aluminum do not correspond in their absorption of filtering quality to one-half millimeter of copper. One millimeter of copper is equal to twenty-three millimeters of aluminum. Ten millimeters of aluminum are equal to 0.4 millimeters of copper. If you take that into consideration you will get it.

DR. BISSELL: I wanted some one to explain somewhat the exact technique for obtaining this wax mold. It seems like a very simple thing to him, but it would be difficult for me to go about that. Does he build the frame work and fill it with the wax or how does he proceed?

DR. SCHMITZ: Equal parts of wax and paraffin should be used. It should be mixed thoroughly, softened in warm water and applied so it will adapt itself to the surface of the body.



Treatment of Focal Infection of the Throat by X-Ray as Compared with Surgical Removal of Tonsils and Adenoids*

W. D. WITHERBEE, M. D.

New York City

THE principle upon which this method of x-ray treatment is based might be stated as follows: both lymphatic and embryonic tissue are more easily destroyed by the x-ray than any other living tissue. The tonsil is made up mainly of lymph tissue, the small fibroid tonsil so commonly associated with rheumatism contains lymph follicles, of which the greater part is embryonic tissue, as evidenced by the mitotic figures. The embryonic tissue in the follicles of the large lymph tonsil is considerably less than is found in the fibroid tonsil. The remainder of the tissue in these follicles consists of mature lymphocytes. Therefore, it is possible to use very small doses of x-ray to promote the absorption of the lymphatic element of the tonsil, which will in no way interfere with any of the surrounding and adjacent cells or glands.

From the standpoint of infection the shrinkage of the tonsil and lymph tissue of the lateral and posterior walls of the throat by x-ray⁽²⁾ will produce a drainage and relieve the distortion of the crypts throughout the entire mucous membrane, which is impossible by any known operative procedure. Out of thirty-six cases in which specimens from the crypts were taken thirty-two showed an absence of hemolytic streptococci and hemolytic staphylococci. This coincides with the results which have so long been obtained in acne vulgaris and also the results first obtained by Dr. Kennon Dunham, of Cincinnati, in the treatment of carbuncle. Recently Dr. Hickey, of Detroit, has carried out this treatment in a series of diphtheria carriers in which he was able to rid the throat of diphtheria bacilli in from two to four days, and this occurred in eighty per cent of the cases treated.

The technique is comparatively simple. In the average case we use a seven inch spark gap, five milliamperes, four minutes time, ten inch distance, and three mm. of aluminum as filter. The patient lies face downward, head turned to the side, the position and angle of the patient and tube corresponding exactly to that employed by the roentgenologist in making a radiograph of the lower molars on an x-ray plate⁽³⁾. The

number of treatments is usually about eight, given at intervals of two weeks, and both sides of the head are exposed

at each treatment. A special table⁽¹⁾ and board have been devised for the treatment of children.



Figure I. Apparatus consists of an oil immersed tension transfer and hot cathode x-ray tube in same tank. This is placed under the leaf at the end of the table. On the leaf is mounted an adjustable head rest with lead lined opening. On one side is the milliammeter filament control and also a switch for turning on the primary current. The filter is attached to the top of the transformer tank so that it can never be forgotten. Target distance is fixed.

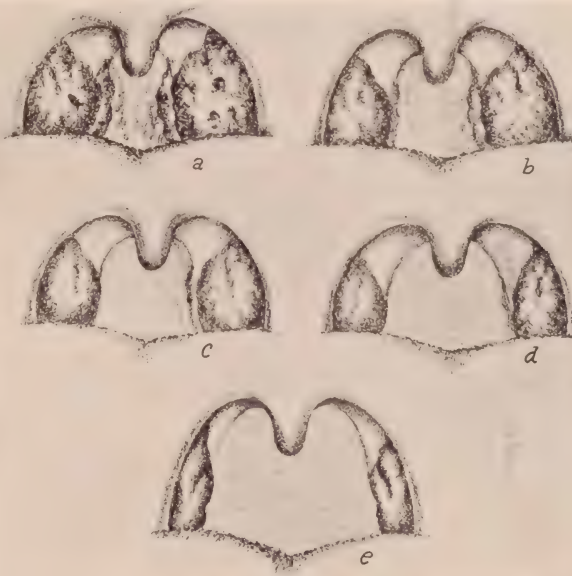


Figure II—a to e. (a) Tonsils before x-ray treatment; large, ragged, crypts contain pus. Large mass of lymphoid tissue behind posterior pillars. (b) Two weeks after treatment; tonsils reduced; surface smooth and clean. Mass behind pillars reduced. (c) Four weeks after treatment; tonsils markedly reduced pale and smooth; no exudate on deep pressure. (d) Eight weeks after treatment; small amount of exudate. (e) Six months after treatment; tonsils small, normal in appearance, no exudate on deep pressure. Lymphoid tissue behind pillars practically gone. Hemolytic streptococci disappeared from throat by second week after treatment.

*—Read at the Annual Meeting of The Radiological Society of North American, Chicago, Dec. 2, 1921.

The same technique, so far as the factors are concerned, is used in the treatment of tubercular glands of the neck and toxic goiter, the only difference being in the area exposed; in the goiter case we expose both the tonsil and the thyroid gland, and in the tubercular gland the tonsils and glands involved. Whether an infected throat has anything to do with the toxic goiter is a debatable point, however, I have seen one case sent into the hospital with an acute follicular tonsillitis which in forty-eight hours developed all the symptoms of toxic goiter. If the infected throat has anything to do with the action of the thyroid gland we might expect better results in these cases if the focal infection in the throat is relieved as well as the effect of the ray on the gland itself. In tubercular glands of the neck the removal of the focal infection in the tonsil and throat will also relieve the primary focus of infection and thus have more lasting effect on the tubercular gland.

The x-ray method of treating chronic

focal infection of the throat, namely, tonsils and adenoids, is not only safe and permanent, but will more thoroughly and completely remove this focal infection than any other method yet devised, surgical or otherwise, and furthermore the contraindications for operation in no way interfere with this procedure. This method, as compared with surgical removal of tonsils and adenoids, is free from serious complications. Following surgical removal one may have all the conditions which arise from circulating septic emboli, lung abscess, empyema, phlebitis, endocarditis, etc., and hemorrhage, middle-ear infection and mastoiditis may also complicate recovery. In the x-ray treatment there are no known complications provided the technique is faithfully carried out. The permanency of the results as well as the safety of this method can easily be checked up by any man who in the past ten years has had a number of tubercular glands of the neck treated by x-ray. Van Allen's recent report of fifty cases in the December Journal of

Radiology is most interesting and instructive.

The objections so far encountered to the x-ray method have been, first, the danger of x-ray, namely, a burn. This is impossible if the technique prescribed is carried out. The possibility of injury to the parotid, the thyroid, the pituitary, and other adjacent glands has been amply tested in the past ten years in which tubercular glands of the neck have been treated by much larger doses, some of the cases receiving as high as forty doses, whereas the dose for tonsils and adenoids has never exceeded fourteen treatments in any given case in a series of nearly five hundred cases which we have treated in the past two years.

In our series of five hundred cases, we have encountered two cases of concealed abscess of the tonsil, revealed by the shrinkage. Both cases were suffering from rheumatism and in both instances the rheumatism was relieved in the early part of the treatment. These abscesses are completely circumscribed and walled off by fibrous tissue and are therefore inert. In one of the cases the abscess ruptured and drained about three months after treatment. The fibrous tissue remaining after x-ray treatment and the encapsulation of these abscesses point out the fact that we leave only that type of tissue which nature utilizes in her defense against infection. This method is especially indicated in chronically infected throats in vocalists, since the muscular reconstruction of the throat is minimum as compared with that following surgical removal of tonsils and adenoids; it is indicated also in these cases associated with rheumatism, chorea, diabetes, chronic endocarditis, haemophilia, or any condition contraindicating operation.

1. The Atrophy of Hypertrophied Tonsils and Adenoids and Other Lymphoid Structures of the Throat Induced by Small Doses of X-Ray.—Dr. J. B. Murphy, Dr. W. D. Witherbee, Dr. S. L. Craig, Dr. R. G. Hussey, and Ernest Sturn, *A. M. A. Jour.*, January 22, 1921.

2. X-Ray Treatment of Tonsils and Adenoids.—W. D. Witherbee, M. D., *Amer. Jour. of Roentgenology*, January, 1921.

3. The Principles Involved in the X-Ray Treatment of Tonsils.—W. D. Witherbee, M. D., *New York Med. Jour.*, March 16, 1921.

4. The Effect of Small Doses of X-Ray on Hypertrophied Tonsils and Other Lymphoid Structures of the Nasopharynx.—J. B. Murphy, M. D., W. D. Witherbee, M. D., S. L. Craig, M. D., R. G. Hussey, M. D., and Ernest Sturn, *Jour. of Experimental Medicine*, June, 1921.



Figure III. Shows position used in treating tonsils with the ordinary x-ray treating tube stand, the tube resting above the patient. The rays are focused over the tonsils by an indicator as shown by the illustration. The surrounding part of the skin is covered with lead foil.



ALBERT SOILAND, M. D.,
Los Angeles, California—President. 1922
The Radiological Society of North America

X-Ray Treatment of Tonsils with the Conjoint Use of the Ultra-Violet Ray*

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THIS is not an occasion to discuss the method of election in the treatment of tonsillar diseases. It is conceded at the beginning that surgical indications exist and should be utilized; but it is also pointed out that there appears to be a class of tonsillar dysmorphies in which x-rays serve eminently well as a therapeutic measure. This seems to be true, particularly in the case of hypertrophied tonsils in children; and it is exclusively upon this subject that attention will be focused.

In the child the lymphatic system is dominantly active, and since the tonsils may really be considered an integral part of the lymphatic system, we may expect hyperactivity in those organs in early age. Those of us who are in accord with the teachings of Colonel Bushnell with regard to the immunizing dose of tubercle infection sustained in childhood by repeated ingestion and aspiration of tubercle bacilli can see in the tonsils a locus through which the circulating tissue of the infant derives its immunologic defense against usual pathogenic bacterial flora. It is not improbable that the physical texture and the chemical constitution of the tonsillar glands are purposely adapted to bacterial culture; for, whether purposeful or not, in children it is a frequent finding to observe subacute infections commonly present.

Assuming that the tonsil, by reason of its position, its histologic texture, and its chemical constituency marked by lymphatic preponderance, is charged with the duty of collecting ingested and aspirated organisms, and also breeds pathogenic organisms in a subactive fashion, it is possible to conjecture a threshold of maximum activity at which pathogenic organisms thrive to a point where focal or systemic infection is not clinically established, though the products of their elaboration are osmoted into the lymph and circulated and distributed throughout the body, raising generally the immunologic titer of the tissues against various infections. Or, to speak in terms of an established science, it seems probable that the tonsils are likely to contribute, during childhood, to the establishment of an immunity. An immunity acquired at so early a date as to be inseparable

from the defense usually recognized as natural immunity.

Speaking only of hypertrophied tonsils in children, there will be observed in the clinic, in the light of the hypothesis presented, three types of tonsillar conditions:—

(1) Those in which the tonsils are obviously hypertrophied, but are not excessively reddened, suggesting by their appearance a minimum bacterial activity.

(2) Those in which an obvious reddening is present, suggesting a bacterial activity, but an activity below the point of clinically established infection.

(3) Markedly reddened and congested tonsils in which infection is clinically established as is evidenced by the accompanying systemic manifestations.

In the first instance, careful observation will develop the singular fact that the child may be classed as a hypomorph of Bean and shows a form of clinically recognized signs indicating a trend in the direction of status lymphaticus. In these cases, according to the terms of the hypothesis presented at the beginning, it would seem fitting to argue that the defensive processes against invading organisms outweigh the power of attack in such fashion as to preclude the establishment of any obvious degree of immunizing infection. Tonsils of this type are, therefore, hypoaactive and bear treatment along the lines that will establish some degree of activity. It would seem that their surgical removal is not at all warranted; for the physical removal would not assist in accelerating a hypoaactive function, but would, rather, by total removal of the immunizing organ, preclude the possibility of any degree of immunizing activity. And in this type of case, if the premises of the immunizing hypothesis are correct, the therapeutic use of the x-ray should be followed by marked success.

Here, the x-ray will reduce the size of the tonsil, through which reduction there will be a proportionately less volume of immunizing surface and material; and if the reduction is carried to the degree where the usual pathogenic organisms may establish their subactive function, the immunologic defense of the child will be placed at normal adjustment. In support of this hypothesis may be cited the unusually brilliant results that follow the

reduction of hypertrophied tonsils in hypomorphs by the use of x-rays. In observations confined to school children of the lower grades the outstanding feature of the improvement seems to be the reflection in the intellectual background and study interest, both are awakened in the previously dulled and intellectually insipid pupil.

The second type, pursuant to the theme submitted, comprises the large majority of school children, in which the tonsils present what we should like to refer to as a state of active immunization. The glands are enlarged, less spongy than the previous type, reddened, but not abnormally so, and give, on culture, more numerous and greater varieties of organisms than the hypertrophy of the first class. In these cases it is contrary to best judgment to intercede with an agent or means that will totally remove the tonsil should indications arise for their treatment. The tonsils appear to be playing a markedly active part in the physiology of the child; and should conditions arise that demand treatment, such as physical obstruction to proper aeration, it is the better course, at least at first, to resort to the use of x-rays in preference to surgery.

In this second type, however, the general systemic level of the child may, for whatever reason, fall markedly below par; and when it does the tonsillar infection acquires a new proportion requiring clinical intervention.

Any form of intervention should be based upon two fundamental principles: First, the immediate correction of the excessive bacterial activity, and secondly, the moderate reduction of the immunizing capacity of the tonsils so that any future impairment of systemic normalcy will not be followed by outburst of focal tonsillar infection. And with these two indications there is a contraindication, the strict avoidance of the removal of the tonsils. The very fact that the tonsils are subacutely inflamed at all times is sufficient index to show the necessity for raising the general immunity of the individual. Surgical removal of the tonsils would preclude the possibility of maintaining this immunizing mechanism after the acute aberrancy has subsided. In this type of cases the x-rays were not as singularly successful as in type one; and the difference in success was attributed to the non-bactericidal action of the x-ray. In other words, the x-ray accomplished

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

the second indication, but entirely failed in the first indication for treatment; that is, it eventually reduced the immunizing activity of the glands, but it failed immediately to correct the acute infectious exacerbation. So that the x-ray treatment in class two should be supplemented by a form of treatment aimed directly at the immediate cessation of the infectious activity. An agent remarkably suited for this indication is the ultra-violet ray. Through its bactericidal influence the acute infection is quickly dominated and the clinical symptoms are therefore speedily removed.

Coming now to the discussion of the third clinical class of hypertrophied tonsils in children we observe the manifestly infected glands. There is a clear and distinct difference between the gland showing active immunologic processes, and the obviously infected tonsils. The characteristics of the former type have been discussed; the features of this third type are well known and may be summarized by saying that the differentiating symptom is the presence of purulent accumulations. Not simply leukocytes scattered over the surface, but definite gatherings of pus in the crypts and spaces on the surface and in the mass of glands.

This type of tonsil is decidedly pathologic. The use of the x-ray, owing to the lack of immediate bactericidal

effect is wholly impractical; and even the powerfully germicidal ultra violet ray alone is far from the most efficient treatment. The indication is not to relieve the pathogenic infection, for even if it were relieved, the major immunizing influence of the gland has been lost through the changes induced by the severe pathogenic inflammation, and will, therefore, contribute little to the immunologic well-being of the child. In these cases, again in the light of the hypothesis presented, the indications are for the surgical removal of the gland.

All of this may be summarized by saying that tonsils in children are divisible into three groups, based on their supposedly immunizing function—

First, the hypoactive.

Second, the active, and,

Third, the infected.

In which we distinguish between immunologic activity and pathologic infection. The immunologic activity is characterized by the thriving of many organisms, saprophytic and pathogenic, below the threshold of clinical infection; whereas, infection is characterized by the presence of one dominant strain of organism that has established an activity that no longer contributes to the physiologic manifestations.

In these cases our experience with school children has been that when treatment is indicated because of the temporary establishment of an acute infection, or because of the mechanical

impediment to normal physiologic processes, better results are obtained in the discriminate use, either alone or conjointly, of the x-ray, the ultra violet rays and surgery; the x-rays being reserved for the hypoactive tonsils, the conjoint use of x-ray and ultra violet rays being especially beneficial in the cases of type two, and surgery being reserved for cases of type three.

The use of the x-rays is already well familiar to every roentgenologist in the form of the Witherbee technique. When it is to be supplemented by the use of ultra-violet rays, the x-ray applications are given every two weeks, as is generally advocated by Witherbee and others; the ultra violet irradiations are applied directly to the tonsil through a pharyngeal applicator in units of actinic saturation, alternating days in the usual case, and daily in the more severe infections.

The choice of surgical operation is left for surgical specialists to decide.

Since the active immunizing types are by far the most frequent that are to be observed clinically, it is obvious that the ultra violet ray plays a significant role in the treatment of tonsillar pathology. The indications are plain, the application is simple and the results obtained through the conjoint use of the x-ray and ultra violet ray in hypertrophied tonsils are eminently brilliant and deserve every consideration.

Radiotherapy of Diseased Tonsils*

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IMMEDIATELY following the announcement of Witherbee and his associates that the x-ray caused atrophy of the adenoid tissue in the tonsil, radiologists realized that they had seen this again and again in their cases of cervical adenitis and hyperthyroidism, but for some reason we had not thought to limit our ray to the tonsil.

It is now about a year since the radiologists, generally, began using this method of treatment, and it may be of interest to take a survey of the field and examine the results. There are two things which we cannot answer positively at present.

First—How long will the results last? That is, will new cells form in a few years and the patient again suffer with tonsilitis? All that we can say

at present is that in adenitis cases in which the tonsil received treatment, no further trouble was experienced with the throat, and some of these cases have been observed over a period of six years or more.

Second—What histological changes do we find in the different types of diseased tonsils after treatment, how long do they persist and do any regenerative changes appear? The patients are so much improved after a few treatments that we have had no occasion to resort to surgery with any of them, and have, therefore, been unable a few months after treatment, to get a study of microscopical sections.

Taking from our files the first fifty cases treated, we find that they fall roughly into four classes, as follows:

First—Adults having large, soft hyperplastic tonsils with deep crypts, generally discharging or containing pus.

Second—Children with large, in-

fectured tonsils and crypts, generally not so deep.

Third—Adults who have had their tonsils, or at least part of them removed and who still have a part of the tonsil with scar tissue present.

Fourth—Both adults and children who have had the entire tonsil removed and have infected and enlarged lymph follicles in the pharynx.

The first class is the type that shows startling improvement. The tonsils shrink rapidly, the crypts can be seen standing wide open and the cultures show wonderful decrease in the number of bacteria. The patient is delighted to find that he stops having tonsillitis and other throat trouble. Of this type we found twenty-nine cases, of whom five stopped having tonsillitis after one treatment, three after two treatments, and the remaining twenty-one received an average of five treatments. The results were satisfactory,

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both to us and to the patient, and we have not thought it necessary in any to give a second series.

The second class of cases are the children with large, infected tonsils. The child normally has a large tonsil, so it is not the object of the treatment to cause complete atrophy, but to cause the diseased portion to disappear and the infection to clear up. This will probably cause the tonsil to atrophy normally as the child grows older. Of this class we found eleven cases. Average number of treatments was six and two-tenths. Results appear perfect in ten. One did not complete the treatment.

The third class is a rather puzzling type. The tonsils have been partially removed, either by surgery or by sloughing and there is present a large amount of scar tissue along with the lymphoid tissue from which pus and debris can be expressed. Generally they consult a doctor for a constitutional trouble rather than a throat condition. These cases always declare that the general symptoms improve and certainly the throat looks better and is free from pus, though there is generally some of the roughened tissue left between the pillars. We found in this series only four of this class, all of whom improved with an average of eight treatments.

In the fourth class we find both adults and children. Again and again we see patients who have had their tonsils removed and have experienced only partial relief. They complain of constant discomfort in the throat with constant desire to clear it and a well defined attack of sore throat at frequent intervals. There is generally not the prostration that typical tonsillitis causes, but a very uncomfortable feeling with slight fever.

Upon examination of the throat, we find a varied condition. In some cases the enlarged follicles are seen covering the whole pharynx and pillars or occasionally just behind the pillars or in the lower angle of the pillars. Generally the entire Waldeyer's ring seems to be involved. The adenoids have generally returned and the lingual tonsil is generally enlarged. The local treatment is only of temporary benefit, and as far as I have been able to observe the x-ray has the most pleasing and permanent effect, although the effect does not appear quite so quickly as in some other types. We have in this series, six cases. Results are apparently good in all, but we are reserving our final opinion in order to watch these cases for a period longer than a few months.

As to technique, we are using in most cases that recommended by

Witherbee, viz.: in adults, five ma., seven-inch spark gap, ten-inch distance, three mm. aluminum, four minutes every two weeks, and children proportionately less. In patients from a distance we use the large dosages, and longer intervals. The greatest number of treatments we have given is twelve.

We would like to draw some conclusions in closing this paper, but aside from the immediate results that are very evident and satisfactory, we prefer to wait for a longer time to formulate our final conclusions.

DR. JOSEPH BECK (*Chicago*): The last paper was a paper that interested me the most and I am sure every laryngologist who has been interested in the removal of or the remedial measures for infected tonsils, especially in children, will want to read that paper, because it is certainly rational, although I am sure we have all been keeping away from tonsils in which we felt there was a hypoactivity or a condition in which the child required the lymphoid tissue. That is the first point I want to make in discussing the paper of Dr. Witherbee.

I have followed this work ever since it was reported in the American Medical Association and put it to work, though not as actively as I shall after this meeting. I have been waiting for this meeting.

The lymphoid tissue negation by the first speaker, Dr. Witherbee, and attributing the formation of connective tissue as a protection against infection is against all physiology so far as I know, and were we able to get rid of infections in tonsils without removing the tonsils, that is the operation we would choose, if there was such a possibility. It is a protection even in the adult, but the infection is in the crypts. The crypts are lined with epithelial cells. X-rays do not destroy those. You can see tonsils that have been rayed a number of times, remove them and the epithelium is degenerated and holds pus sacs.

In cases in which the indication is so clear as endocarditis, and so many other distinct indications for the removal of tonsils, are you going to treat a pus sac by x-ray? I say there is no place for x-ray in a condition of that kind.

The pictures that were shown of massive tonsils with lymphoid enlargement are an old story. X-ray removes lymphoid tissue, but does it remove the infection? We have to see the reports and describe the action of the x-ray. They are not bactericidal; other rays must be used and therefore, that presentation to me is no criterion whatever. If I heard Dr. Witherbee's paper I should not be encouraged in applying

x-ray as a means of treatment. My experience in so far as x-ray treatment is concerned has been limited to cases where surgery was contra-indicated, as in pulmonary tuberculosis, in which there was an infection, there was a distinct septic infection in the tonsil. Second, hemorrhagic tonsil; I mean spontaneous hemorrhage of the tonsil in a definitely proven bleeder. Third, a case of glycosuria, diabetic, where there was an enormous amount of sugar in his urine. The patient was seventy-six years old and we would not operate. For that kind of a condition that would be indicated. To me the last speaker's paper will be of value in trying the x-ray as well as possibly the other ray. I do not treat with the x-ray, depending upon the radiologist to do that work, and trying to follow the technique as Dr. Witherbee presented it. I think we are indebted to Dr. Witherbee for presenting the paper, but at the same time the conclusion to open the subject by making the statement that there is no need for surgery. I leave to you if that is sound judgment. I thank you. (Applause).

DR. AUSTIN A. HAYDEN: I have been interested by the papers which have been read. I have been considerably resuscitated by Dr. Beck's very forceful remarks.

I saw the pictures which the doctor was showing and heard his remarks about the non-necessity for removal of tonsils and I must say I felt very uncomfortable. However, gentlemen, I realize from the work I have seen some of the members of your society do in this connection, more especially, however, from the work that I have seen them do in the treatment of goiters, that the opening up of this field by an association of the standing your society has, is a distinct advance and may be—and I emphasize the words *may be*—a very considerable advance in scientific medicine.

Just as Dr. Beck said, however, we cannot but look with a considerable amount of skepticism on the treatment that has been advocated for septic tonsils, for instance.

I have been unfortunate enough to have been visited with such an infection a few years ago, and the results of that I feel sure with the multiple arthritis I had, with the glycosuria, I do not feel for a minute I would have been safe to have placed my case in the hands of a radiologist exclusively. I think those conditions are surgical and will always remain surgical. However, if I understand the question correctly, the changes which the rays produce or which the violet rays produce (I have not used these myself; whatever work has been done by members of your

society), I do not understand that these changes are essentially different from the changes which physiologically occur in every tonsil in middle life or after puberty has been reached. The general contraction of all gland tissues which occur, physiology shares in for that reason. Hypertrophy of tonsils in adults is extremely rare, large tonsils being seen in children.

For the cases which do not seem to be infected, but which are obstructive (that is, which obstruct the passage of food or the passage of air or the ventilation of the posterior larynx or ventilation of the eustachian tubes), in which there is no suppurative, no sinus disease, no running ears, I would be inclined to think that the methods you gentlemen have proposed this afternoon are strictly in order and probably will be found to be permanently, highly efficacious. For the tuberculous conditions Dr. Beck has spoken of, for the suppurative conditions within the tonsil crypts, I must say that I view the suggestions that have been made with great hope, but, however, with great skepticism. I thank you. (Applause).

DR. McCANDLESS: There is a tendency to argue the question rather than to bring out the scientific factors in the work. One of the chief arguments in favor of our work was brought to my own mind from the fact that when this subject was first mentioned to us, I began examining those patients who have had heavy exposures of the cervical and tonsillar area in cases of epithelioma of the lower lip—cases that had been treated some five and ten years prior to the examination.

These, of course, were adults, largely. In these adults it is presumed they have the throat of normal adolescence and that we would find there the mucous membrane a smooth, shiny, velvety affair that one would expect in a normal adult. After having examined these throats, I attributed much of the result, that is, this velvety mucous membrane to the effects of the ray. I still think there is a marked difference in the appearance of this mucous membrane in those patients so treated and the usual adult throat. The juvenile type of tonsil when it is found in the adult is, of course, rare. We have found in one patient at the age of seventy, the gross appearance of juvenile tonsil. That patient was a suf-

ferer from rheumatism—quite an old lady. After some eight or nine exposures after the technique mentioned here, the results were relatively satisfactory. There was quite an appreciable relief in the rheumatic trouble complained of.

Of the five doctors on our floor that have been treated, one was a sciatic case with relief having come. In considering our results, it is a question of relief from pathology. The decrease in the size of the tonsil, of course, has given these patients very much more room for breathing. That is conceded by all of us.

Getting back to the question of infection, I do not know what has taken place in these throats, because either the patient refuses operation afterward because of dread of the knife or assumes that he has been relieved. They will possibly resort to subterfuge to avoid tonsillectomy after our work.

Relative to the permanence, all of us who have spent any number of years in this work, know that the gland atrophy in other parts of the body is a relatively permanent thing. No recurrence of glandular tissue is to be looked for after long, continued radiation. I believe that more work is required to produce the results in these tonsil cases than we have been using. We have increased some of these treatments—in creased the number of ten, eleven and even as many as fourteen treatments. The relief from the rheumatic pains has been the greatest result obtained in the adult. In the children, of course, the regression of the lymphoid tissue. I see no great disadvantage in using this agent first. It is scarcely fair to bring up the problem of lung infections and the untoward results that have occurred after surgery and use them against the nose and throat man. It engenders an antagonism that I feel will not promote this new work. That seems to me to be extremely valuable.

I hope that in the number of cases, representing about seventy-five now, we will be able to get a compilation of throat cultures, of throat measurements. We are trying to measure the distance between the tonsil and the throat in relative repose. Later we hope to get the removed tissue for section, which we have not been able to get yet. I feel we have made a definite advance. Dr. Beck said that pus pockets must

be removed. I do not believe there will be a great amount of controversy if you will choose those cases. In the light of another year or two we will be enabled to choose cases suitable for work. (Applause).

DR. WITHERBEE: Gentlemen, as far as the nose and throat man is concerned I can see his viewpoint and handwriting on the wall. I am not talking of a few cases. I have treated between four and five hundred cases and I think I know what I am talking about. (Applause).

In regard to the infection in these crypts, I do not think that any one can fall down on this sort of a proposition. If the crypts in the tonsils are filled with infective material, treat 'em. You have done away with the crypts if you carry it far enough. Who cares how they are lined?

I have heard a great many of these propositions against the use of x-ray in tonsils. Now let us go back a little bit in the history of this organization. This is not new. It is like a lot of other things. You have all done a great deal of therapy. You have treated tubercular glands in the neck. Many of you know that the throat man said: "Clear up those tubercular glands in the neck and when you get through I will take out the tonsils."

Tubercular glands have been treated for ten years, at least. Why do I say that the results are permanent? Examine these cases treated ten years ago, in which the whole side of the head was treated by x-ray and look at those throats. I have seen some well four years and no trace of trouble whatever.

Since we introduced this treatment we have exposed only this small area from the ear to the hyoid bone. We have, however, heard a great deal about complications from the x-ray, its effect on the parotid, on the thyroid, on the pituitary and all that stuff, when previous to this the tubercular gland case received ten times as much treatment as you have to give tonsil cases and we never heard anything about ill effects.

If you think of that from the standpoint of ringworm of the scalp, how many children have been treated for it? The technique requires five portals of entry, all directed at the pituitary gland, no result, thin skull, small children. I guess that is all.



Organ Stimulation by Roentgen Ray*

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IN reviewing the therapeutic accomplishments of irradiation in internal medicine one gains the impression that the yield, despite the great amount of time and investigation spent in the field, has been very modest. Excluding tumor work, we find successful application in the leukemias, the lymphogranulomas, in some forms of tuberculosis, in thyroid dysfunction—a relatively moderate return in therapeutic results, particularly if we contrast this with the marked development of the diagnostic use of the roentgen ray.

Popular and even medical attention has always centered about irradiation in connection with malignant tumors. This has involved, naturally, the idea of tissue destruction and as a result roentgenotherapy has been oriented almost wholly about this particular phase of the effect of irradiation, rather than about other and perhaps more useful effects that can be achieved. I believe that this fact has been most unfortunate in the proper development of its therapeutic possibilities.

It is a fundamental biological law, and one to which there are but few exceptions, that agents which in large doses injure or destroy tissue, will, in minute or moderate dosage, act as stimulants. Virchow as early as 1858 recognized this fact, but the broad basis of the phenomenon was not generally accepted until the papers of Arndt and of Schulz appeared, since then it is commonly called the Arndt-Schulz law. Might it not be possible that the therapeutic yield of irradiation would be materially extended if this old Arndt-Schulz law were more commonly considered by the roentgen therapist? It seems that, probably by largely stressing the destructive effects of irradiation, we have neglected the development of a field of roentgen therapy in the direction of selective functional tissue and organ stimulation.

The diametrically opposite effects of irradiation that has its basis on dosage, has been sufficiently impressed upon us by the formative stimulation of small doses, which, long continued, will produce malignancy, while the same rays employed in different dosage may cure a malignant condition. We see the

functional effect frequently enough after thyroid irradiation, where the metabolic rate and the general symptoms of intoxication may be augmented for a period of days or even weeks after treatment. Schmidt⁽¹⁾ in a recent histological experiment has demonstrated this general phenomenon in a beautiful manner. He observed cells exposed to roentgen rays for varying doses, and noted that those cells that received a stimulating dose took up vital stains more readily, those that received a somewhat larger dose were stained more diffusely than the normal cell, while cells killed by massive doses took up no stain at all.

We were led to a study of this particular problem because it forms a collateral field of nonspecific therapy. It is recognized that one may at times achieve quite remarkable therapeutic results in acute infections and in chronic inflammatory conditions when a variety of agents—these include vaccines, milk, protein split products, colloidal metals, etc.—are injected either intravenously or intramuscularly. The results, when this form of therapy is successful, are due to tissue stimulation, either general or local. The Germans use the term "plasmaactivation," the French emphasize the serum alterations which follow such procedures and speak of the "hemaclasic crisis." Included in these general terms are the mobilization of antibodies, of enzymes, thromboplastic substances, tissue metabolites, glycogen, etc., as well as important alterations in the permeability of cells. We believe that in certain diseases a general stimulation, such as is involved by "protein therapy" might not be desirable; would it be possible in some cases to selectively stimulate certain organs and thereby bring either direct or remote therapeutic results? In the second place we would have to consider the possibility that the general reaction that follows irradiation, particularly of the abdominal region or of large tumor areas, etc., may have a therapeutic effect in the sense of a protein therapy. We shall not go into this latter possibility at the present time, but wish to point out that Kaznelson and St. Lorent⁽²⁾ as well as Giraud and Pares⁽³⁾ have recently presented evidence that such may actually be the case.

In our own investigation we found that functional stimulation of an organ

might readily be observed, following moderate doses of roentgen rays, in organs having an external secretion, such as the liver, the kidney, etc. In the case of the liver, the stimulation was apparent in both an increase in the quantity of the bile flow as well as in the amount of bile pigment secreted; in the case of the kidney by an increase in the amount of urine as well as the total amount of nitrogen secreted.

In the following protocols are shown the effects of kidney irradiation on the amount of urine secreted. The experiments were carried out as follows: The dogs were anaesthetized, the ureters isolated and catheters inserted. Next, the circulation of both kidneys was clamped off and the clamps left in position for forty-five minutes. During this time and following throughout the experiment the animals were kept under large doses of morphine. The clamps were removed after forty-five minutes, then one kidney was rayed, the dose varying from five to ten minutes, ten inch focal distance, six inch spark, three ma., no filter.

Dog No. 90—Renal vessels clamped at 2 P. M.; at 2:45 irradiation of right kidney.

URINARY SECRETION

	Left Kidney	Right Kidney
First sample 6 P.M.	2.3c.c.	4. c.c.
7 "	1.2c.c.	4.8c.c.
8 "	1.4c.c.	7.6c.c.
9 "	1.4c.c.	5.1c.c.

Totals. 6.3c.c. 21.5c.c.

Dog No. 91—Renal vessels clamped at 7:30 A. M.; at 8:30 irradiation of right kidney.

URINARY SECRETION

	Left Kidney	Right Kidney
First sample 9:45—0.	0.	0.
10:45 0.	0.	0.
11:45 0.	0.	1. c.c.
12:45 0.	0.	1.5c.c.
1:45 0.	0.	1.6c.c.
2:45 0.	0.	1.5c.c.
3:45 0.	0.	2. c.c.
4:45 0.	0.	2. c.c.
5:45 0.2c.c.	1.1c.c.	
6:45 0.5c.c.	.8c.c.	
7:45 0.5c.c.	.5c.c.	
8:45 0.2c.c.	.2c.c.	

Totals. 1.4c.c. 12.2c.c.

Not in every case were the results as clear cut as in these two experi-

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 8, 1921.

ments; in some instances the anaemia was too prolonged and no secretion took place from either kidney; in some experiments the irradiation was not sufficient to stimulate the renal epithelium to greater activity in the relatively short time permitted in experiments conducted in this manner.

If we examine the subject of functional organ or tissue stimulation in its clinical application we must consider two methods of approach. The first is a direct method in which we seek to stimulate a hypo or dysfunctioning organ to greater activity. Under this head we might consider the *anurea* in an acute parenchymatous nephritis (as simulated in the kidney experiments described), stimulation of the liver in *hepatic intoxication*, operative, cirrhotic, etc.; stimulation of the bone marrow in certain forms of *anaemia*; stimulation of the endocrine organs, such as the ovaries in functional amenorrhoeas, the testicles (as in the Steinach experiments); the hypophysis in *growth disturbances*, and perhaps in some types of *polyurea*; the adrenals in *Addison's Disease*; the pancreas in *diabetes*.

A number of German roentgenologists have become interested in recent years in therapy along these lines and a series of observations has been collected. To Stephan ⁽⁴⁾ we perhaps owe the clearest recognition of this direct effect of roentgen rays on hypofunctioning organs. Stephan's paper takes up very thoroughly the theoretical basis for the work and he illustrates his conception with three clinical conditions, that is, diabetes, acute parenchymatous nephritis and achylia gastrica, in which stimulating doses of roentgen rays brought about distinct functional improvement. Fraenkel ⁽⁵⁾, too, has insisted on the importance of therapeutic irradiation from this point of view. Thus he stimulates the ovaries in cases of amenorrhoea, the periosteum in old, poorly healing fractures; the thymus and hypophysis in osteomalacia, and has, in several papers called attention to the effect of remote irradiation on tumor treatment, believing that our present methods of huge doses will be found of less value than those methods which stimulate the natural forces of the organism to greater resistance to the invasion of tumor cells (connective

tissue reaction, enzyme mobilization, lymphocytic reaction).

Stettner ⁽⁶⁾ has followed the same idea in raying the hypophysis in growth disturbances. Levy and Weinstein ⁽⁷⁾ sought to establish a stimulating dose for the adrenal by measuring the effect on the blood pressure after regional irradiation. They came to no definite conclusion, however. Szego and Roth ⁽⁸⁾ in studying gastric secretion after irradiation found that only doses greater than an erythema dose gave first evidence of irritation, to be followed later by depression. Brugel ⁽⁹⁾ found only a lowered secretion after irradiation. On the other hand, it is to be recalled that irradiation of the gastric region (entailing as it does simultaneous effects on the liver, the pancreas, the spleen and the colon as well as loops of the small intestines) is most frequently followed by evidence of intoxication (Miescher) ⁽¹⁰⁾ the effect of which must naturally influence the stomach secretion.

Perhaps one of the most interesting applications of this idea is that which concerns the pancreas. We shall not go into the extensive literature concern-

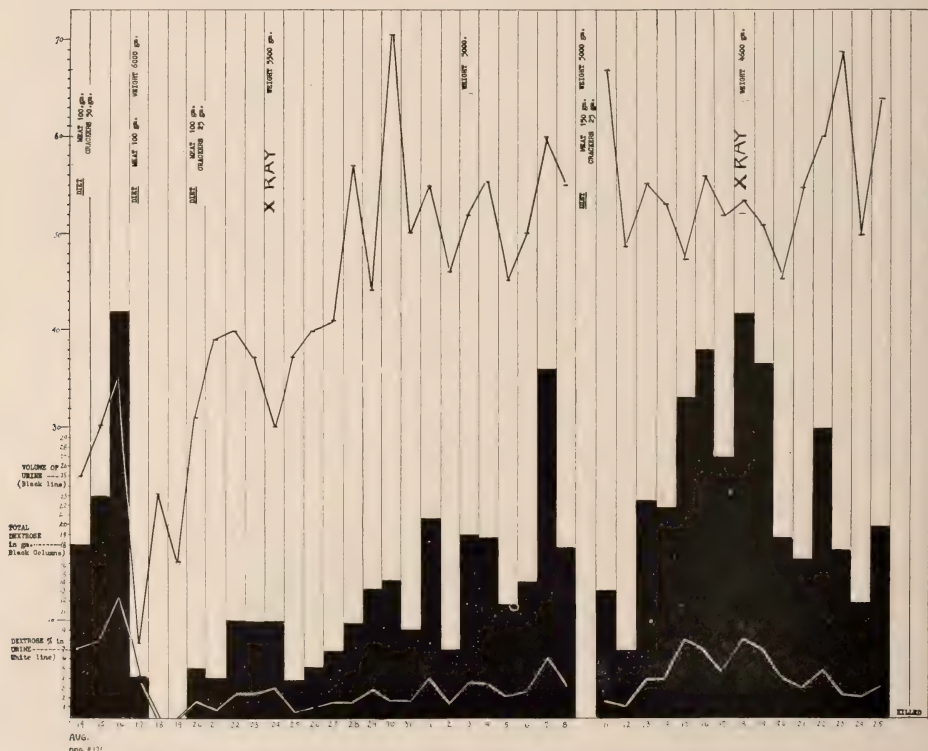


Chart No. 1. Effect of roentgen irradiation of the pancreatic rest on the sugar tolerance

ing the effect of irradiation on the diabetic individual. The general experience has been that irradiation, particularly of the abdominal viscera, or of neoplasms, results in an increased sugar mobilization. This corresponds to the general effect that we get in the diabetic after protein therapy, after hemorrhage, after adrenalin injection, etc. Apart from the work of Stephan no efforts have heretofore been reported dealing with the direct stimulation of the pancreas; we should, therefore, like to present some experimental evidence in this connection, carried out on partially depancreatized dogs. The animals were, of course, kept on a constant diet and the effect of irradiation on the sugar output studied.

The following two experiments are typical and similar in character to those which we previously described⁽¹¹⁾.

Dog No. 171, Chart No. 1.—Weighed 6800 gm. Operated Oct. 7, 1921, when 14 gm. of pancreatic tissue were removed. The animal made an uneventful recovery and began to excrete sugar on the 4th day after operation. On the 14th the animal was placed on a diet of 100 gm. meat, 50 gm. of cracker meal and 200 cc. of water. On this diet the amount of sugar reached 42 gm. excretion on the third day and the animal refused food. The cracker meal was then eliminated from the diet for three days, after which twenty-five gm. were again added. On this diet approximately 10 gm. per day were excreted (Oct. 23 and 24). The animal was irradiated on the 24th of the month (10 minutes, no filter, 3MA. 5 inch spark and 10 inch focal distance). This was followed by a definite reduction in the sugar excretion to 3.07 gm. on the following day, with a step like rise in the days following—5 gm., 6.8 gm., 9.7 gm., 13 gm. After this time the sugar excretion was ir-

regular. On Nov. 11 the diet was increased by 50 gm. of meat, the amount of carbohydrate being kept as before. The animal was again rayed on the 18th. The average excretion for the seven days before the irradiation and including the day of exposure was 27.3 gm. The average for the seven days after exposure was 21.6 gm.

Dog No. 105, Chart No. II.—Weight 12,400 gm. Operated July 13, 1921, when 23 gm. of pancreatic tissue were removed. The animal made an uneventful recovery and began to excrete sugar on a diet of 200 gm. meat, 100 gm. cracker meal and 50 gm. of dextrose. The amounts are made evident in the chart. The animal was irradiated on the 10th of August with the dose used in the first animal. There was at first an increase in the amount of sugar excreted; this was followed by a period of three weeks which were sugar free except for a few days when some sugar was noted. After this time the diet was increased at first 75, later 100 gm. of dextrose being added. Irradiation at this time was followed by a distinct lowering of the sugar tolerance (Sept. 22) which was made even more apparent after a third irradiation on the 29th of the month. The experiment makes evident the fact that a moderate dose may at first be followed by evidence of increased tolerance and no injury to the pancreatic function, while repeated doses (cumulative effect) give evidence of pancreatic injury and lowering of tolerance.

In general we may state that our experiments have shown that with moderate doses of roentgen rays applied over areas containing pancreatic rests there may result: First, an augmentation of the sugar excretion, which we assume is due to the general tissue stimulation and is comparable to the effect in diabetic patients of a variety

of procedures, protein therapy, intercurrent infection, adrenalin injection, etc. Second, this effect is frequently followed by evidence of pancreatic stimulation with increased sugar tolerance, in some instances reaching a maximum in about three days after the irradiation, in others evidently persisting for some time (three weeks) after the treatment. Third, if the dose is too large or if a cumulative effect is produced there results lowering of sugar tolerance, indicating injury to the pancreas.

In passing we would call attention to the fact that the conditions for successful experiments of this type are much more favorable in the dog than in the human case of diabetes. The pancreas are nearer the surface, the skin of the dog is relatively resistant to irradiation and the pancreatic rest represents relatively normal tissue, which may react in a more favorable manner than pancreatic tissue already pathologically altered.

However, even in clinical cases there is some evidence that with proper apparatus a diabetic process may be influenced by direct irradiation; the paper of Stephan is of particular importance in this connection and I hope that we may soon have his evidence confirmed in clinical cases from roentgen laboratories equipped with high voltage apparatus.

We have mentioned another possibility, namely the effect of irradiation on remote pathological processes when some organ complex is exposed. It is, of course, well known that following the irradiation of the abdominal viscera, cell-rich neoplasms, goiters, etc., a general systemic reaction takes place, ranging from a transient malaise to profound intoxications and shock pictures and even death. Such effects must be due to substances (protein split pro-

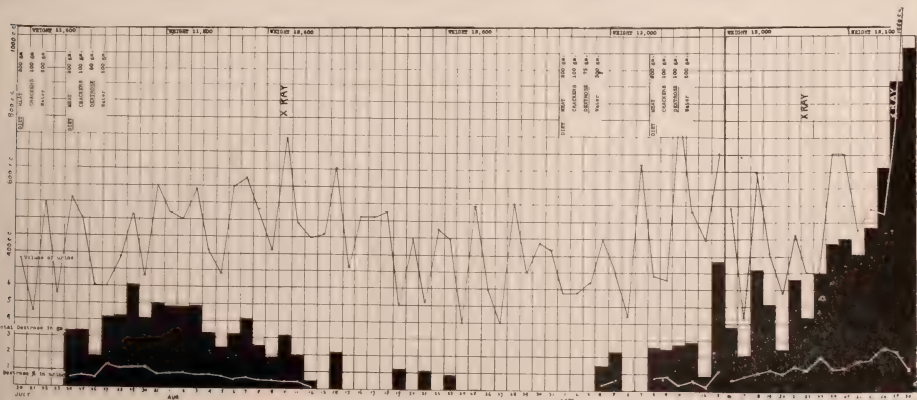


Chart No. 2. Effect of roentgen irradiation of the pancreatic rest on the sugar tolerance

ducts, enzymes, cellular detritus, etc.), that enter the blood stream from the organ rayed. So, too, it is known that a focal activation of chronic inflammatory foci takes place after remote irradiation, as for instance in arthritis, lupus, furunculosis, etc. This phenomenon must also be due to substances carried through the blood stream.

We have, therefore, examined the differences that may be determined in the serum when different organ groups are rayed for different time periods. In this work we selected the hepatic, the splenic and the lower abdominal region, realizing, of course, that in no instance would we be getting effects of actually isolated organ raying because of the simultaneous effect on neighboring tissue. Inasmuch as the details of these experiments have been published, we wish at this time merely to point out the general character of the observations.

It was found that the leucocytosis that followed such regional irradiation varied. Irradiation of the hepatic area resulted in a sharp but transient rise; of the intestinal area in a step-like increase in the number of leucocytes; of the splenic area in the frequently observed diminution of the white count. Coagulation changes followed after irradiation of all the areas exposed⁽⁴⁾. Enzyme alterations were noted to be most marked after irradiation of the hepatic and intestinal areas; the splenic irradiation was least effective in this connection. These alterations may have some significance in the phenomena to which we referred, namely roentgen intoxication and the focal activation by remote irradiation.

In conclusion, I should merely like to point out once more the two possibilities of approach to therapeutics by this means. We have first of all the direct method whereby a hypofunctioning or dysfunctioning organ is stimulated to increased function. The experimental evidence that we have presented for the kidney and the pancreas would make this method one to be considered in certain cases of nephritis and of diabetes. While we would not at this time suggest the clinical application of the method in the diabetic amenable to dietetic treatment until more knowledge has been gained with experimental work on animals, it might perhaps be warranted in diabetic coma where other methods have failed. The same is true of kidney conditions.

The second method is an indirect one, and takes into consideration the fact that the roentgen shock is akin to protein shock and has, therefore, a certain *a priori* basis for therapeutic effects⁽¹⁵⁾. There is, furthermore, the possibility that by stimulating certain normal organs we can throw substances into the circulation which may have an effect on remote disease processes. We believe that roentgenotherapy along these lines may have a considerable field of usefulness not heretofore developed.

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Status of the Radiologist in Small Communities*

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THIS short paper was written under the impression that others should know the quandaries in which the serious radiologist, far from his colleagues in the same specialty, often finds himself. He must be everything from a technician to a diplomat, and one false diagnosis in a small town may cost him his practice. Even though he may be so fortunate as to possess a good technician he must still do much of that part of the work himself. Often the doctors in his territory are loath to send their patients for diagnosis, fearing that their own reputations may suffer thereby, and so with rare tact the radiologist must explain to the patient that it is only to confirm the diagnosis of the general practitioner that his art has been called upon. Above all, must he come to his community well equipped with medical and especially surgical knowledge. He must be well versed in gross and microscopic pathology and not think that all he has to do is to buy a good transformer and some milligrams of radium to insure success, and he must keep in mind that x-ray or radium is not a panacea. Only through repeated lecturing and reading of papers before the small medical societies and even to lay audiences will he be able to open the door to deserved recognition of his specialty.

The consulting radiologist is a specialist and I am glad to say that after a number of years of work, two of which have been in the service, I have arrived at that position. To me a real radiologist is a consulting physician who adds to his instruments of diag-

nosis a knowledge of roentgenology, and to his general therapy adds that of x-ray, radium or fulguration. He must be imbued with confidence in the power of, and inspired with the love of, his profession, for only this will spur him on to keep abreast of the times and to seek advice from his colleagues of the larger centers, and especially from the pioneers in the work. So will he open up the path into the community which he has chosen as his and make it a center of good work to which his colleagues will send their patients because they trust the probity and the skill of the radiologist, and to which the patients will unhesitatingly come for like reasons.

All this will not come without time and patience. How many times have I been asked to extract some foreign body under the fluoroscope with the doctor who brought the patient in, acting as assistant surgeon! How many times have I had to explain to some doctor, without giving offense, that the appointment for a gastro-intestinal examination must be left to me, and the patient not sent for an examination between trains! Many physicians still think that the diagnosis of tuberculosis can be read from the plate as from a magic book. Here we must make it clear that accurate and sufficient clinical findings must be given us before our branch of science can render aid. Many doctors come to us and consume our time in showing them the plates and explaining to them a lot of things which they do not know, after which they go back to their patient and tell him they have seen the plates and read them!

Many patients come to us in fear and trembling asking if it "is going to

burn much." I have learned in one of our great western clinics the secret, in part, of its success. The patients are allowed to mingle and talk with one another, even sometimes assisting in fluoroscopic examination. Thus they learn that there is no magic behind the doors and they gain an intelligent, if limited, understanding of, and a respect for, and confidence in, the profession of the radiologist. Besides this, the realization that the next one may be worse off than he himself is often has a good psychological effect upon the patient. Such an atmosphere accompanied by smiles and kindness, and yet with firmness, will add immensely to your personality, and though the patient may not go away cured, he will go convinced that everything within the power of present day science has been exerted for his benefit.

Not only must the radiologist be capable, thorough and careful, but he must guard his integrity and his reputation jealously and wisely. What will you say to the patient sent to you for radium treatment after a Halsted operation if you do not yourself examine her completely? I will show you among my slides such a patient sent to me. After examination I refused to treat her unless the husband was told of her condition so that he would not afterward think that we had not done all we could and feel that he had spent his money for nothing. I would not give her so many hours of radium and then send her home with false hope. That is not our duty, as I see it, and we must not allow ourselves to be told by some surgeon what to do in order that he may, excuse the expression, pass the buck.

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec., 1921.



EDITORIAL

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The Future of Medicine

MOST medical men are fatalists, whether they admit or deny it. The fact is, they see so much of the effects of social and individual degeneracy in its ramified forms that they accept the conditions as they find them in a detached and disinterested fashion. It couldn't possibly be otherwise, because if the busy medical practitioner were to let every case of physical suffering or mental anguish produce its counter-effects on his emotions and passions, he would, within the first busy fortnight, become a physical and mental derelict—a maniac in a padded cell to prevent him beating out his own brains.

Certainly this condition presents a neurosis that is not going to be overcome by taking a pink pill or even a compound cathartic. The affliction does not involve the intestinal tract. It is a question for the neuro-psychiatrist. And he will find it a difficult, if not an impossible, job to determine those issues which involve the nature of the man, the effects of the social sphere in which he moves, the scope of the purposes of the individual and their relation to the social purposes which inhibit, distort and encourage the professional ego.

Man is neither aggressive nor creatively purposive when he is physically and mentally exhausted. So it is no wonder that the busy medical practitioner, who eats when he can, sleeps when he must, and spreads merry sunshine when his heart is skipping and his soul is sodden, finds neither the time nor the inclination to erect for himself and his fellow-men a philosophy of life. At best, his is a perfunctory existence, with the daily grist of bellyaches and hysteria, demanding a pill here and a bit of good advice there, till his troubled mind becomes case-hardened and finds comfort in the belief that whatever is to be, will be, and it may as well be now so as not to prolong the agony.

But however much the medical man as such may revolt at the thought of being held responsible for the prevention as well as the cure of those physical and mental ailments whose familiarity has already filled his heart with contempt, that is precisely the thing being demanded of him—a job which hangs over his head like the sword of Damocles ready to fall if he refuses this socio-scientific function or whether he accepts it and fails ignominiously in achieving something no other human being has ever been able to achieve.

Stated succinctly, the facts which constitute the present dilemma of medical science, are:

1. Individual health and happiness are both cause and effect in the social health and happiness, wherefore medical science is compelled to admit its ministrations can never be made fully purposive until that science embraces and directs man's social habits, relations and contacts.

2. Sociology and psychology are just as important as biology in any rational and intelligent effort to accomplish preventive and curative medicine.

3. So far as practical medicine is concerned, speaking now both preventively and curatively, the individual, physically and mentally, must be studied as a complete functioning organism if the utmost in health, happiness and usefulness is ever to be either approached or achieved.

In support of this view, it is our honor and pleasure to quote from a personal letter written by Dr. Abraham Myerson, Assistant Professor of Neurology, Tuft's College Medical School, Boston:

"(1) I conceive that the highest goal of human effort is the development of the human personality in efficiency, happiness and dignity. Other results of culture and social effort seem to me to be secondary. I, therefore, believe that medical science, in endeavoring to bring about this social aim, must ever keep in mind that the human being is not divisible in two parts, a physical and psychic, but must stress that all the physical conditions of living which hurt the human being in any way hurt his personality; that bad housing, slums, preventable disease, under-nutrition, overwork, etc., are not only detrimental to what is ordinarily called health, but detrimental as well to personality."

"(2) Medical science, of course, must go much further than this. It must insist that the emotions, the purposes, and the intelligence of man are socially determined as well as biologically determined. It must, therefore, look with a candid eye into the purposes of society and into the traditions, culture and ethics of the various groups of society, and endeavor to determine how much of this is rational and in accordance with what we really know about the human being, and how much of it is dead weight and an impediment handed down from our own unenlightened ancestors. We may conceive that a man struggling against wrong ideals, traditional purposes, and ancient ethics may injure his body and may injure his mind, and in view of these injuries our science is called in as a consultant. I feel very strongly with Freud that a scheme of society has to be organized in accordance with the nature of man, though I differ with him in my conception of what that nature is."

"(3) It thus comes about that medicine as a socio-scientific unit leaves its swaddling clothes of the care of the individual in accordance with materia medica and therapeutics and steps into a much bigger role. It brings its knowledge to bear on the fields of public sanitation, on the fields of social reform and social legislation, on the fields of ethics and education; in a word, on the culture of the world in which it operates. As a neuro-psychiatrist, I am compelled to answer questions every day which must take into account the nature of man, the nature of society, the individual purposes, and the social purposes, and I believe that medicine as a whole must become the great consultant and director in all the other fields of human activity."

"Foundations of Personality"

ANY serious effort to prescribe the sphere of influence of medical science in the social welfare leads back immediately to questions involving the nature and functions of the individual. That there is some causal connection between those conditions one sees in

WHAT IS MEDICINE? the social body every day and the traditions, habits, and environments by which men formulate their conduct, there isn't any doubt. That these same facts also spell the job the science of medicine must assume cannot be denied. And notwithstanding the blight of mental inertia which is the inevitable consequence of a fatalistic proclivity, here and there occasionally one finds in the medical profession an active mind trying to set its house in order and project itself into the future of medical science.

Such an one is Dr. Abraham Myerson, of Boston, whose latest book on the "Foundations of Personality" is the most rational, lucid, and serious presentation of individual and mental co-ordination, expression and control found in the literature of modern medicine.

Starting from the premise "that the mind is the function of the organism * * * that the body is a living thing and as such is as spiritualistic as life itself; that enzymes, internal secretions, nervous activities are the products of cells whose powers are indeed drawn from the ocean of life"—a cardinal principle which the author substantiates by scientific and facts of common knowledge showing, first, dependence upon proper brain function and structure, and second, dependence on proper health of the other organs, Dr. Myerson analyzes the human body as a functioning organism, physiologically and psychologically, and strips the thing called personality of all the mysticism and mystery so shamefully prevalent because of sheer ignorance and theological teaching.

Three quotations, the first taken from the chapter entitled "Intelligence and Will," at page 115, the second and third from the chapter discussing "The Sentiments of Love and Hate" at pages 161 and 163 respectively, will serve to show the serious way in which the author proceeds in the development of his subject:

"* * * Intelligence deals with the relations between things * * * and intelligence only becomes intellect when it is able to see the world from the standpoint of abstract ideas, such as truth, beauty, love, honor, goodness, evil, justice, race, individual, etc."

"In passing, an interesting development of our times is worth noticing. The tendency is to discard established codes, to weaken dogma, and to throw more responsibility on the individual conscience."

"In the end, the true sense of duty is in a sense of individual responsibility. Our age feels this as no other age has felt it. Other ages have placed responsibility on the church, on God, and on the state. Difficult and onerous as is the burden, we are commencing to place duty on the individual, and in that respect we are not in the least a decadent generation."

Surely here is an undercurrent of social theory and practice that is of vital concern to medical science. With all the world demanding a high degree of individual intelligence and responsibility, there is bound to develop an even greater ratio of demand in this respect upon the man of science who professes to know how men should conduct themselves and why that conduct should conform to certain standards.

The tremendous range of medical contact with the question of human actions and reactions with their concomitant effects on the individual health is undoubtedly responsible, at bottom, for the spirit of specialization in the medi-

cal profession. Dr. Myerson illustrates this situation in a very naive manner when he says on page 194, under the chapter heading "Energy Release and the Emotions."

"You may know a man (or woman) not by his lip-homage, but by what he genuinely admires, by that which evokes his real enthusiasm and praise. Judge by that and then note that the most constant admiration of the women of our country goes out to actresses, actors, professional beauties, with popular authors and lectures a bad second, and that of the men is evoked by prize-fighters, ball players, and the rich. No wonder the problems of the world find no solution, for it is only by fits and starts that men and women admire real intelligence and real ability. The orator has more admirers than the thinker, and this is the curse of politics; the executive has more admirers than the research worker, and this is the bane of industry; the entertainer is more admired than the educator, and that is why Charlie Chaplin makes a million a year and President Eliot received only a few thousand."

And again, on pages 195 and 196 of the same chapter when he touches the other extreme in the dominating forces of human conduct:

"Though the reverent spirit is admirable and poetic, it is not by itself socially valuable. It has been played upon by every false prophet, every enslaving institution. It prevents free inquiry; it says to science, 'Do not inquire here. They who believe do not investigate. This is too holy a place for you.' We who believe in science deny that anything can be so holy that it can be cheapened by light, and we believe that face to face with the essential mysteries of life itself even the most assiduous and matter-of-fact must feel awe. Man, the little, has probed into the secrets of the universe of which he is a part. What he has learned, what he can learn, make him bow his head with a reverence no worshiper of dogmatic mysteries can ever feel."

There is but one place in the entire book where the author seems to have relapsed from the keenly analytical and intellectually prescient method which is so pronounced in all the remaining pages. That is to say, A CLASH OF PRINCIPLES if one is to carry over the abstract principle first quoted, that is, "Intelligence deals with the relations between things * * * and intelligence only becomes intellect when it is able to see the world from the standpoint of abstract ideas, such as truth, beauty, love, honor, goodness, evil, justice, race, individual, etc.", and use it as a test in dissecting the following statement, found on page 234 under the chapter heading "The Evolution of Character," there seems to be a maverick in the lot not heretofore present:

"The world is built upon the sacrifices of the idealists, and eternally it crucifies them. Wealth and power are to him who has a marketable commodity, and one cannot complain when true genius becomes rich. But the genius to make money may be and often is—an exploiting type of ability, a selfishly practical industry which neither invents nor is a great service. The men who do the basic work in invention and scientific work in laboratories are poorly paid and only now and then honored. Every year in the United States, hundreds of them leave their work in research and seek paying jobs; to the impoverishment of the world, but to their own financial benefit. Countries where the scramble for wealth is not so keen, where the best brains do not find themselves pressed into business, produce far more science, art, and literature than we do, with all our wealth. We will continue to be a second-rate nation in these regards, still looking for our great American novel and play, still seeking real singers and

artists, until our idealism can withstand the pressure of our practical civilization."

There can be, of course, no serious denial of the facts on which Dr. Myerson builds his conclusion. But looking at the whole problem in an abstract way—an impartial way—one is inclined to ask whether the greater part of the scientific work of the world has not been entirely unattached, and to offer the suggestion that this utter lack of co-ordination of effort and correlation of achievement has rendered the product of scientific labor largely invaluable in and of itself. And by the same token, laborers in the scientific realm cannot complain if they find no real market for their services until they do for themselves what they profess to do for others. It would indeed be a strange anomaly if those men and women of science who claim to know how to devise human health and happiness for others cannot demonstrate their ability in this respect in their own work and lives. And in this connection, the statement is made without fear of successful contradiction, that the greatest weakness that science in all its phases must overcome is the utter lack of organized effort according to some common plan which will not in any way restrict, but on the contrary, will enlarge the possibilities of, and give direction and purpose to, the labors of all scientific men.

Any other conclusion is hardly tenable in view of the social contacts of medical science. Dr. Myerson aptly epitomizes the problem which is causing such a stir in the field of science when he says, on page 269 in discussing "The Methods of Purpose":

"As the factory system develops, as 'efficiency' removes more and more of the interest in the task, social unrest will correspondingly increase. One of the great problems of society is this:

"How are we to maintain or increase production and still maintain the love of work? To solve this problem will take more than the efficiency expert, who works in the interest of production alone; it will take the type of expert who seeks to increase human happiness."

This very naturally involves the science of medicine, as well as all science, because it may be accepted as a truism not requiring demonstration here, that human happiness is not attainable to the fullest extent except as it is founded on physical health and mental stability and purpose.

There are a lot of other important and interesting features developed by Dr. Myerson. But it is impossible to cover all of them in this discussion. Some of the most significant thoughts have been picked out and considered briefly. On the whole the book is one whose thoughtful study should prove valuable to every member of the medical profession and be kept in the library for constant reference. It can be procured from the publishers, Messrs. Little, Brown and Company of Boston.

Scientific Research and the Radiologist

IF one were truthfully to answer the question, "What has been the single greatest force in the advancement of medical science?" he would, obviously, be compelled to say "scientific research."

SCIENTIFIC RESEARCH . . . If one were equally candid in answering the question "What single agency contains the greatest promise for the future development of medical science?" he would be obliged to say "scientific research."

And if, perchance, one should exhibit sufficient temerity to ask the same questions and demand like answers concerning the science of radiology—a branch of medicine—he would still be confronted with "scientific research,"

Perhaps these questions seem unnecessary and silly. But when one goes deeply enough into the matter to set up the facts concerning the conduct and plan of scientific research in medicine, and particularly in the field of radiology, he runs head-on into two things, first, that there is neither co-ordination of effort nor correlation of labor, and second, that, generally speaking, those persons most vitally interested in the science, especially radiologists, have done, and are now doing, absolutely nothing to foster consistent, continuous, and exhaustive research for the purpose of extending the field of operability and definite applicability of its curative and preventive powers wherever there is human suffering and the question of health is involved.

There are, of course, many institutions and individuals working out specific isolated problems. Medical colleges and other institutions of higher learning are struggling along as best they can with limited funds and without any particular encouragement. A few individuals, comparatively speaking, are trying to carry a back-breaking burden and give to their profession absolute data which will enable others to relieve and prevent human distress. But for the most part, these men are working alone, driven beyond their capacity because of the great possibilities they see in scientific achievement, and assailed constantly and everlastingly by the realization that single-handed it is impossible to turn back the flood of human suffering and give men those facts on which they can base a practical knowledge of life. There are, also, other institutions endowed by philanthropic men with what seem almost fabulous sums until one looks at the job from the inside-out, and not from the outside-in.

But over and above the question of funds, there is a profound problem—the absolute necessity for a universal interest in and active support of scientific research. This is a condition precedent to anything like co-ordinated effort according to some preconceived and correlated plan, because the research worker must be, and is, constituted very differently, mentally and environmentally, than is the ordinary medical practitioner, whether that term be used in the broad sense or applied to some specific specialty.

As a proper beginning, it must be recognized that scientific research is the work of individuals. As it must, also, be recognized that if those individuals are ever to do anything worth while, viewed from the angle of BURDEN large social service, they must be sustained and BEARERS supported by those for whose benefit they labor.

And in order that their labors shall be made as effective as possible, they should have constant contact with, and receive suggestions from, men engaged in the practical application of the science to humanitarian service under all sorts of conditions in all phases of society.

As it is now, a few men are doing research work, some with very limited funds, which they are able to secure from philanthropic sources, and others are attempting to serve two masters by trying to divide their energies between a practice which provides a living and scientific exploration which makes living worth while. The result is that he is more than an extraordinary man—indeed, he is a very rare bird—who can apply himself successfully and fruitfully in consistent laboratory work year after year, and at the same time conduct a professional practice to discharge his obligations decently and honestly to himself, his family and society.

So much for this phase of the subject.

The natural questions that now demand very serious and prolonged consideration are, how are these conditions to be overcome? What is the duty of the medical man? What is the responsibility of the radiologist?

These are tremendous problems. The sheer magnitude of their scope will frighten a great many men and they will wander off into specious diatribes about the traditions of the profession, about ethics, and numerous other things which

do not involve the enormous responsibility inherently bound up in this sort of a constructive program.

However, the more thoughtful and courageous will observe a few facts which indicate the place of beginning, a few opportunities which hold out possibilities of large and beneficial research.

First: There are numerous medical organizations which should foster and financially support scientific research.

Second: There are already many institutions and laboratories which would be willing to undertake work of this character under the direction of the medical profession if funds for that purpose were made available.

Third: There are many individuals capable of performing various functions in a co-ordinated and correlated program of this sort if directed and financed either on a full-time or part-time basis.

Fourth: There is already in existence a wealth of data of one kind and another touching the social as well as the strictly medical phases of the public health.

Fifth: The problem is not one of providing an eternal social solvent, because any thoughtful person will realize there is, there can be, no such thing. Rather it is a question of method purely. Through scientific research the working tools can be provided whereby the medical profession, and the radiological profession, can with some degree of assurance meet the constantly shifting problems of their daily practice. By the establishment of certain definite and absolute principles and the building up of machinery for the intelligent assembly of facts, there will be set in motion methods of precision which will be capable of attacking seriously any condition, due respect being had, of course, for the essential element of time.

With these very definite and tangible factors as the basic element of their research activities the Radiologists, who are primarily medical men, and The Radiological Society of North America, which has assumed the initiative in this important field of scientific advancement, more particularly as it relates to the science of radiology, can, if they will, accomplish incalculable results—results which will dignify their profession by greatly enlarging its possibilities in therapeutic work.

So that, no matter whether one looks at this job from the high professional level of a scientific obligation met and fulfilled, or from the purely personal plane of self-interest, he cannot help finding sufficient justification for his unqualified support of the undertaking. It is not, in any sense of the word, another charitable donation added to the already overwhelming list. It is an investment even more certain of returns than schooling and laboratory and office equipment.

The May Meeting

THE attention of radiologists is again called to the fact that the mid-year meeting of The Radiological Society will be held at the Planters Hotel, St. Louis, on May 19th and 20th. Hotel reservations should be made at once directly with the hotel. It is suggested, however, that if later you find it impossible to be present, your cancellations should be sent to Dr. E. C. Ernst, Humboldt Building, St. Louis. By so doing, you will enable him to take care of unexpected reservations coming in at a later hour.

Special railroad rates have been arranged on the certificate plan. When you buy your ticket ask the agent for a certificate. The announcement of the reduced rates has been made conjointly with the meetings of the American Medical Association, The Radiological Society of North America, and allied organizations. It will be necessary for you to mention this fact to the ticket agent so that you may have the opportunity of taking advantage of the early selling

dates which are necessary if you wish to attend the meeting of The Radiological Society. No matter if you are coming only a distance of fifty miles, ask for the certificate just the same. At previous meetings a number of men who came short distances thought it would not pay them to bother with the certificate. As far as their own personal saving was concerned on such a short distance the saving was very small, but these certificates are issued on the basis of selling a certain number, and if that number falls short through the thoughtlessness of those coming a short distance, it works a very great hardship on those men coming from a great distance.

These certificates must be turned in at the registration desk when you first come, as they will have to be validated and returned to you later. Please bear these details in mind and act accordingly and promptly.

Preliminary Program

THE following constitute the original scientific theses which will be presented at the May meeting of The Radiological Society in St. Louis. This is a preliminary program announcement. The complete program will appear in the May issue of The Journal.

"The Effect of X-Ray on Cell Division"—Jas. W. Mavor, Ph. D., Schenectady, N. Y.

"Does Radiation Enhance Post-Operative Recurrence of Carcinoma of the Breast"—M. J. Sittenfeld, M. D., New York City.

"Present Status of Radiation: Therapy with Case Reports"—J. Thompson Stevens, M. D., Montclair, N. J.

"An Estimate of the Value of Perirenal Emphysema in Diagnosis"—L. T. Le Wald, M. D., New York City.

"Combined Radium and Diathermy"—C. W. Hanford, M. D., Chicago, Ill.

"Treatment of Uterine Fibroids with Slides Showing Original Appliances"—James N. McCoy, M. D., Vincennes, Ind.

"The Determination of the Intensity of X-Rays of High Voltage"—Henry Schmitz, M. D., Chicago, Ill.

"The Inheritability of Spontaneous Cancer in Mice and Its Application to Man"—Maud Slye, M. D., Chicago, Ill.

"The Etiology and Pathology of Cancer"—L. Loeb, M. D., St. Louis, Mo.

"Radiotherapy in Carcinoma of the Larynx with Special Reference to Needling Through the Thyroid Membrane"—Geo. E. Pfahler, M. D., Philadelphia, Pa.

"Protecting Patients from the High Voltage Line"—Albert Soiland, M. D., Los Angeles, Calif.

London Congress

WE are informed by Dr. A. E. Barclay, of Manchester, England, that there will be a congress on radiology held in London, June 7th to 10th. A very cordial invitation is extended to any members of The Radiological Society or radiologists from America who are not members of the society to attend this congress.

The doctor remarks that the congresses in England are not quite so strenuous as those which he attended while in America, and that the men there give more attention to the social side of the meeting, feeling that they obtain as much, if not more value from meeting people away from the set discussions than in the actual meetings themselves. This remark shows the spirit of the men and we hope that any one who is in England at the time or who is planning a trip abroad can so arrange his itinerary that he may be present at the congress mentioned.

Research Bureau

IT will be recalled by the members of The Radiological Society who attended the last annual meeting that during the year 1921 President Williams appointed what was called a committee on research. The personnel of this committee was as follows: Carl Ballard, M. D., Omaha, Nebraska; Thomas A. Burcham, M. D., Des Moines, Iowa; Fred S. O'Hara, M. D., Springfield, Illinois; Albert F. Tyler, M. D., Omaha, Nebraska.

This committee was appointed for the purpose of carrying on certain investigations relative to the best manner of co-operating in research already under way in America, and, if necessary, planning for research on certain specific problems about which the members of The Radiological Society might be concerned.

During the latter part of the year 1921 the situation was investigated and a report of the committee was given at one of the executive sessions of the last annual meeting as follows: "Your committee would recommend first the establishment of a department of research by The Radiological Society; second, that the president appoint a committee empowered to work out the details for proper functioning of this department." The report was accepted and the committee continued for another year with the personnel unchanged. It was suggested that the committee continue its work during the year 1922, aiming, if possible, to lay out a definite plan of operation to be followed by the society in establishing a research department or bureau.

The committee is now working on a plan which ought to show some results in the near future. As fast as the plan becomes definitely formulated we shall be glad to publish further information.

Licensing Technicians

THE remarkable growth of the field of radiology has required the services of a large number of specialists in the use of roentgen rays and radium to diagnose and treat disease. Creation of local, sectional and national societies has about completed the pioneer labor of workers in all parts of the country, so we have now available the ordinary contacts with fellow-workers and the older and broader scientific bodies. There is necessary still greater development of these organizations. Scientific research, standardization of technique, a uniform language, and recognition of high ideals are different phases that must go on as progress is made.

Until recently the technicians have not received any special attention. They have been looked upon as individuals selected to carry out the routine labor about the laboratory. They have been trained according to the particular job offered. By far the greater number have come from the ranks of the nursing profession. Many have been bright office girls made over from the ranks. Some, like Topsy, "just grewed." There are a few male technicians who are employed. A place exists for them in certain larger clinics and in some lines of the specialty.

Certain evils have grown up, due to this haphazard development of the technical field. All agree that the greatest harm is being done by the technician who on his own responsibility, or under the guise of reputable protection, conducts a laboratory, giving opinions and advice in diagnosis and treatment. A few women are doing this, but by far the greatest number of offenders are male technicians. In some states they are asking for legal recognition, and have received special protection from the full enforcement of the medical practice act, just as osteopaths, Christian Scientists, and other irregular practitioners have done.

This is not the only evil that has arisen. The next one is an injustice to the honest, square technician. It is the com-

plete disregard of the technician, his rights and his perquisites. On first thought the need of standardization and high ideals among technicians may not be great, but sober reflection brings the inevitable conclusion that more attention to the technicians will elevate this class of skilled workers and promote the right ideals. If there are standards for selection and standards in training and experience, there will grow up a capable body of assistants valuable to any radiologist. "The workman is worthy of his hire." Technicians exist, they carry heavy responsibilities, and they associate daily with the radiologist.

For over a year a commission appointed by The Radiological Society of North America has been studying this problem. They have had advice from every part of the country. They have acquainted themselves with the needs of clinics, hospitals and private hospitals. Often they have found conditions very different where situations are dissimilar. Conclusions generally applicable have crystallized out. At the last annual meeting in Chicago the Society definitely decided to establish a board to license and control technicians and to set up certain standards for selection and procedure. This movement has been launched. In a short time it is hoped that the actual work of the board will have begun.

There is agreement on some of the standards to be used in selecting candidates. For instance, it is agreed that the most desirable technician is a woman, and that she should be a trained nurse. A technician must not diagnose orally or in writing, nor treat on individual responsibility, nor practice in an office separate from a duly licensed doctor or dentist, and must always be under direct medical or dental supervision.

The following recommendations have been adopted for the certification and control of ethical roentgen technicians. The Board will be glad to receive any helpful suggestions and advice. Already letters are being received from training schools asking for requirements so that their nurses may be graduated into preparation for roentgen technicians. **RECOMMENDATIONS FOR CERTIFICATION AND CONTROL OF ETHICAL ROENTGEN TECHNICIANS**

1. A board of five shall be appointed by the president of The Radiological Society of North America, consisting of three roentgenologists, members of this society, one physician and surgeon recommend by the American Medical Association, and one technician of reputation and standing.

The members of this board each will serve three years, a new member being appointed each year.

The purpose of this board will be to examine and control acceptable technicians seeking certification as to their ability to practice as assistant to any reputable physician, surgeon or dentist.

This board shall formulate its own rules and regulations, in so far as they do not conflict with the recommendation now being made. It is the purpose of these resolutions to give wide latitude in the control of technicians and revocation of recognition when the board sees fit.

2. The applicants for certification shall be twenty-one years old, male or female. They shall have the equivalent of a high school education and that of a trained nurse. The board shall determine the meaning of the word "equivalent." They shall have served at least two years with some reputable physician or institution.

3. Examination shall be made possible for any technician applying who has furnished proper credentials. It shall consist of written and oral demonstration covering physics, equipment, dark-room service, anatomy, technique and experience.

4. A certificate shall be issued to those who demonstrate sufficient knowledge and experience. This certificate shall be good only so long as the owner is under the direct

supervision of some reputable physician, surgeon or dentist, and not in an independent office.

5. In the main we endorse the constitution of the American Association of Radiological Technicians.

6. It is hoped that co-operation can be obtained between this Society, the American Roentgen Ray Society, and the Canadian Roentgen Ray Society. To this end the board shall carry on negotiations with them, seeking to consummate this co-operation by the next annual meeting.

7. All legal matters or efforts to repress the lay x-ray laboratory which might arise in the work of this board shall be referred to the Committee on Frauds and Practice.

8. Power is given to endorse and recognize training schools and roentgenologists whose standards satisfy the board, and also to revoke the same for cause.

AMENDMENTS

(a) The three appointees from The Radiological Society shall serve for three years. The appointee from the American Medical Association shall serve three years, and from the Technician's Association three years.

(b) Definition of Nurse: A graduate of a recognized school, and registered in the state.

E. W. R.

Radium Insurance

NOTICE was recently received from Lloyd's insurance agency of London that hereafter the rate of complete coverage insurance on radium would be five per cent. This is two and one-half times the rate previously charged and means that one is paying one-twentieth of the value of the radium annually for insurance. This raise in rates probably means that losses of radium have been so frequent that the lower rate was unprofitable to the insurer.

There are doubtless several factors entering into the frequent losses of radium. One is the fact that the insurance was for full value, which meant that if the radium was lost the only real suffering on the part of the owner was the inconvenience of being compelled to help make a search for it and the lack of income from its use during the interim elapsing before it could be replaced. The psychology created in the owner by this condition led to less care in handling than would otherwise be the case.

Out of three losses in this immediate vicinity two were in hospitals and one in an office. In both losses in hospitals, nurses removed the radium with dressings, the whole mass going into the incinerator before the loss was discovered. When analyzed, this kind of a loss means that the nurses having charge of the radium were not fully instructed about its value and use. We feel that this kind of loss could be prevented by either forbidding the removal of radium by nurses or by more careful instruction to them. Another means of preventing this kind of loss would be to fasten to the radium a large metal tag painted red and labeled in some manner similar to the following: RADIUM, DO NOT REMOVE.

The third loss occurred in an office, the radium apparently having slipped from under the dressings, for it was not present when they were removed. So far as we are informed this radium was never recovered. This kind of loss is due purely to carelessness in applying the radium to the patient, combined with allowing the patient too much liberty during the treatment. This much, then, for the responsibility of the careless owner who brings about the large percentage of losses, and in this manner compels the careful man to pay for his carelessness.

Let us now look at the insurance situation as it exists today. So far as we are informed, London Lloyd's and the Automobile Insurance Company of Hartford, Connecticut, are the only companies offering insurance on radium. A recent communication from one of the local representatives

of the Automobile Insurance Company, shows the following limiting clause a part of the policy contract:

"No claim to attach hereto for loss while any radium insured hereunder is used on or about patients unless such patients at the time of loss are under the exclusive care of a registered or hospital nurse, medical doctor, and, or, his assistant to the exclusion of other patients."

A representative of the Insurance Company offers the following interpretation of the limiting clause quoted:

"By medical doctors' assistants we mean those who are taking the prescribed and recognized course to fit themselves for the medical profession. In other words, those students known to hospitals as internes."

"By registered nurse we mean those who have taken the prescribed and recognized courses in hospitals to fit themselves to be trained nurses."

"By hospital nurses, we mean those who are taking the prescribed and recognized courses in hospitals to be trained nurses."

"Practical nurses, unless they have taken the prescribed courses, or orderlies, are not sufficient under the policy."

Defining the term "assistant," this agent adds:

"An assistant to the medical doctor may be any one he may elect. It should be clearly understood, however, that the person so designated by the doctor is to be one who is capable of being recognized as an assistant insofar as his or her knowledge of the element is concerned and ability to properly handle or supervise the patients undergoing treatment. *In other words, the person elected by the doctor must be familiar with the uses of radium, and have no other patients to care for or no other duties to perform during such time as the radium is applied to the patient.*"

Particular notice should be given to the italicized words.

To illustrate: If two patients were sitting in a doctor's office with radium applied at the same time, it would be necessary to have either two doctors or two registered nurses in constant attendance to meet the terms of the policy. For each additional patient another doctor or another nurse must be provided. On the other hand, if a patient is being treated at a hospital, a trained nurse must be in constant attendance during the treatment time. For each additional patient an additional trained nurse is made necessary.

We are not sure but what two nurses would be necessary, one for night and one for day. We hope to have an interpretation of this point soon. You can readily see that where one nurse is required for each patient it means an added expense of not less than nine dollars per day, six dollars wage and three dollars for meals. If two nurses, one for day and one for night, are required, it would mean eighteen dollars per day, which interpreted in terms of the usual three day application of radium would cost the patient seventy-two dollars for nurses besides the hospital bill. We doubt whether such a program could be put on with the patient of average means. This requirement would practically stop all use of radium on charity patients because they would not pay the nurse and the hospital would not furnish one.

Taking into consideration the "limiting clause" and its interpretation by the insurance company representative, the policy is really of little value to the owner of radium.

It would seem from consideration of the above statements that there are three possibilities of relief from this situation. First, that the Automobile Insurance Company voluntarily change the wording of its "limiting clause," leaving out the word "exclusive," so that one nurse or one physician may supervise more than one patient at one time. Second,

that the Automobile Insurance Company issue a policy with a three-fourths loss coverage clause. This would enable the company to write such insurance at a reduced premium, since they would not bear the whole loss, the owner assuming a certain portion of it. Third, the formation of a mutual insurance company, the stockholders consisting of owners of radium.

It appears to us that the second plan would be the best if it can be carried out. There are several arguments in its favor. The fact that a well established, financially sound insurance company is back of the policy would be the greatest argument. We believe, however, that where the owner is compelled to assume a portion of the loss that carelessness would be largely eliminated, which would in turn react favorably on both the insurer and the insured.

Dr. George E. Pfahler of Philadelphia, president of the American Radium Society, has already sent out a questionnaire to all members of that society soliciting an expression of opinion from them. We shall hope to have additional information about this question in the future. Suggestions will be gladly received.

Deep Therapy

ONE of the outstanding features of the Chicago meeting of The Radiological Society was the intense interest in the subject of deep therapy shown by such a large majority of the attendants. This was reflected in a large measure by the fact that no less than seven different types of the newer high voltage instruments were exhibited by manufacturers. This is of singular significance in that it shows with what rapidity our specialized medical group is taking advantage of every new development that promises a more accurate weapon in our concerted fight on localized malignancies. The very pleasing fact is apparent that our American electrical engineers and manufacturers are sincerely anxious to devote their time, money and skill to the production of reliable apparatus which will give to us these precise instruments of utility.

Sufficient data is already accumulating to prove conclusively that the shorter electrical wave produced by higher voltages is destined to prove a more curative factor in our cancer work. While realizing the greater potential danger of these high voltage machines, let this not deter us in a united effort to master these accrued forces, to the end that we may evolve a uniformly standard technique, which will prove just as exact in our work as that of the scalpel in the hands of the highly qualified surgeon.

ALBERT SOILAND, M. D.

Registration of Technicians

WE are informed that there is now a bill before the state legislature of Massachusetts in session in Boston looking to the registration of x-ray technicians. We are not informed as to the text of this bill nor as to its program. We shall possibly be able to furnish more information later.

"Roentgenology as a Specialty"

THE following editorial, appearing in the Southern Medical Journal, March, 1922, issue, under the above subject, is such a sensible discussion of the question, that it is reprinted in full:

"The roentgen ray has probably contributed more to the recognition of gross pathology in the living subject than any other discovery of the past twenty-five years. Through a gradual process of development it has become not only of inestimable value in the diagnosis of disease, but also a very great aid in its treatment.

"Roentgenology has been brought to its present high state of attainment almost entirely through the efforts of men who have given intensified and highly specialized attention to the subject. No noteworthy exception to this rule can be recalled. This fact alone is ample justification for the existence of roentgenology as a medical specialty. There are, however, other equally important considerations which render its perpetuation as such highly desirable. In unskilled hands it ceases to be an asset, and actually becomes a menace. It is realized, of course, that one who is not a roentgen specialist may acquire considerable skill in roentgen diagnosis in certain restricted fields, but as a matter of fact even this is somewhat exceptional. It may, therefore, be stated as a generally recognized fact that no one can be expected to have a full and comprehensive knowledge of roentgen diagnosis and therapy who does not give it his full and undivided attention.

"Unfortunately the roentgenologist is not always accorded the prerogatives of a medical consultant, but is still regarded in certain quarters, both lay and professional, as a special kind of photographer, whose chief function is that of 'picture' making. On the contrary, he is first and foremost a physician who is specially skilled in the diagnosis and treatment of disease by means of the roentgen ray. His relationship to the practice of medicine is not essentially different from that of any other specialist, which, in addition to intensive training along special lines, presupposes a comprehensive knowledge of the fundamentals of medicine as a whole.

"This misconception of the function of the roentgenologist is at least one of the factors that has led to a very serious perversion in its practice. This consists in the widespread distribution of the so-called 'commercial laboratory' which grinds out 'x-ray pictures' at so much 'per.' These commercial laboratories bear a relation to the roentgenologist which is somewhat analogous to that of the spectacle seller to the ophthalmologist, but are far more pernicious, in view of the fact that they have a much wider field for exploitation.

"They are not only a menace to the public weal from a purely medical standpoint, but one of their chief dangers lies in the fact that they will greatly hinder the development of roentgenology along rational and scientific lines.

"It is quite true that roentgenology is one specialty that is perhaps, in certain quarters at least, somewhat undermanned. This fact may be advanced as an excuse for the development of the commercial laboratory, but the fostering of such laboratories, especially by the medical profession, may be regarded as one of the surest ways of aggravating the condition, granting that such exists.

"It is a regrettable fact that the medical practice acts of the various states do not construe the making of roentgen examinations to imply the 'practice of medicine,' thus placing roentgenology, in a restricted sense at least, in the same category with a variety of other pseudo-medical cults. Such an anomalous situation should, of course, be corrected. It is our purpose for the present, however, to point out the fact that the existence of the commercial x-ray laboratory depends in a very large measure upon the patronage of the medical profession itself. Some of the profession support these laboratories with a view to fostering and exploiting their own chicanery, while others do so through a woeful ignorance of the possibilities and limitations of the roentgen ray as a diagnostic aid. There is still a third group which gives them either active or passive support, simply because they have not given due consideration to the evils which such a practice entails. It is particularly to the latter group that we appeal for co-operation in correcting an evil which has already spread to an alarming extent."

DEPARTMENT of TECHNIQUE

Deep Therapy Treatment Room

A. F. TYLER, M. D.

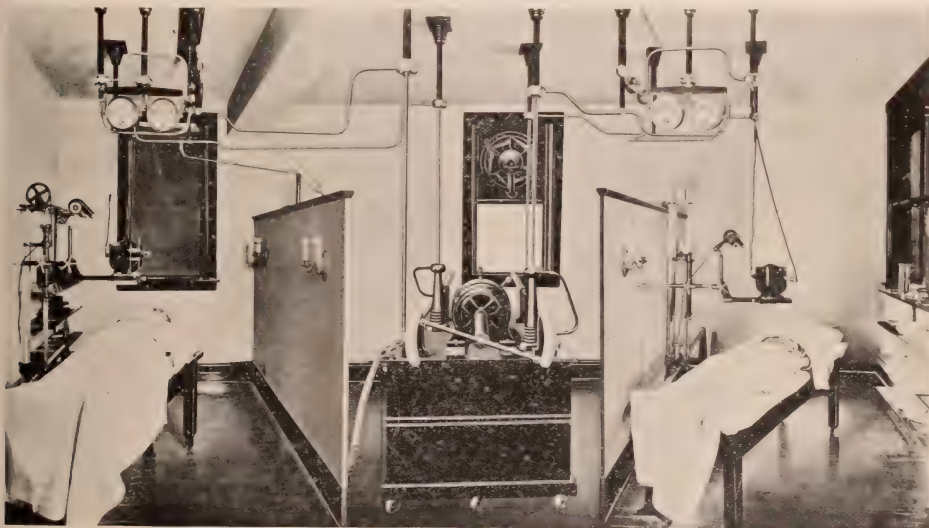
Omaha, Nebraska

IT will be recalled that in the February number of The Journal floor plans of my deep therapy department were shown. By referring to those plans you will see that the treatment portion is divided into three rooms, a transformer room in the center, with a treatment room on either side. You will notice that in the lead covered wall running across the north side of these three rooms there is a lead glass window through which the operator can observe both patients and the transformer in operation.

The illustration used this month is an actual photograph of the three rooms as seen by the operator through the lead glass observation window. On close examination it will be seen that the patient lies on a wooden table, that the tube and high tension connections are fifty to sixty centimeters above the level of the patient's body; and that the high tension circuit is made up of brass tubes measuring three-fourths inches in diameter. This effectively cuts off the effluve and consequently the production of large quantities of gas

in the room. It will also be noted that in the window of the transformer room there is a Sorocco blower which when in operation exhausts the air from the room continuously, keeping it free from noxious odors.

We show this photograph to demonstrate the feasibility of this floor plan, the ease of operating and of placing the patient for treatment of various parts of the body, also the method of keeping the air free from bad odors, and the protection for the operator.



NEW EQUIPMENT

A New Deep Therapy Protection Shield

IN view of the extraordinary difficulties encountered in providing insulation and x-ray protection for a tube operated under nearly three times the highest voltage formerly employed, the Wappler Electric Co., of New York has expended considerable time experimenting to obtain the necessary experimental information for the design of a protective shield which adequately and efficiently takes care of all the factors presented by the new problem. They have, therefore, investigated in all details the following points:

First—efficient protection against the highly penetrating rays.

Second—efficient and dependable electrical protection for the patient against high tension shock.

Third—protection against the nitric fumes, oxone and static or corona discharges from the terminals of the tube.

After having extensively experimented with protection shields made of lead impregnated Bakelite and hard rubber, lead glass, etc., and also having extensively experimented with the

tube submerged in oil, the engineers of the Wappler Electric Co. have arrived at the conclusion that these devices, while they may be sufficient for operating the tube up to a back-up of ten inches, are entirely inadequate for successful long period operation of the Deep Therapy Tube up to the maximum of eighteen inches gap. Moreover, after having made a very careful study of the electrical fields around the tube during operation, they have designed a metallic shield which completely surrounds the tube and which unquestionably offers the best solution to the requirements above enumerated.

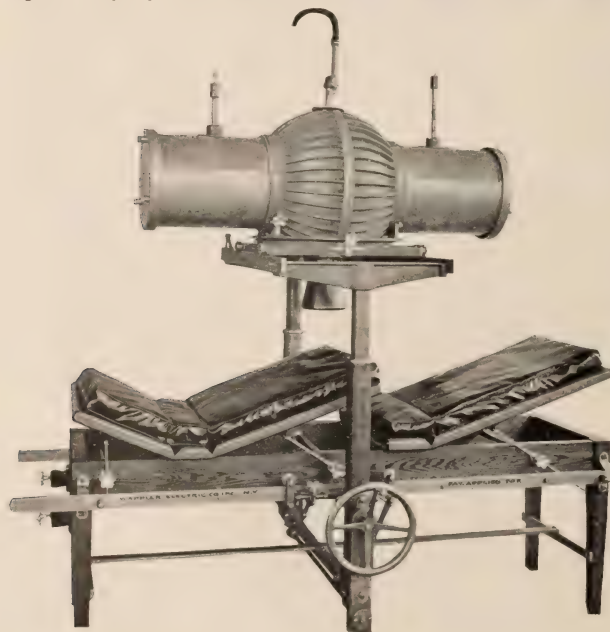
ad 1—Protection against the x-ray is secured by making a drum, which surrounds the bulb of the tube consisting of metallic lead and supporting metal to an equivalent of one-fourth inch metallic lead. In connection with this they have found that this thickness of metal gives excellent protection, but that, on the other hand, if the tube is not completely enclosed, stray radiation and secondary radiation coming

from exposed objects nearby are much more harmful and injurious than any rays which might possibly pass through one-fourth inch lead. In a case of further doubt it would be easy to increase the thickness to any desired extent. The tube, therefore, is completely surrounded with x-ray opaque material so that either with the fluoroscope or with photographic plates or even with an electroscope it is not possible to discover any way nearly the quantity of rays reaching the outside which is present if the tube is enclosed in a shield with projecting tube terminals or of such other shields as have been tried.

ad 2—The question of electrical protection of the patient has only timidly been dealt with in the past, but the mere fact that in this device the x-ray tube is enclosed in a metallic container which is grounded, creates electrical protection for the patient which in sureness and reliability is not approachable by any other device heretofore suggested. The tube shield can be touched while the tube is in operation with the full voltage.

ad 3—Both in Europe and in this country the question of protecting the patient against harmful effect of vitiated air, resulting either from having been exposed to the x-rays or from corona discharges at the terminals of the tube, have hardly been considered at all except in a few isolated instances. It is, however, definitely known that if all the vitiated air is efficiently removed the patient is then not exposed to these fumes and the after-sickness and nausea resulting from massive dose treatments are practically absent. When consulting a number of roentgenologists they all agree that the usefulness of roentgen ray therapy could be extended to another class of weaker patients, which otherwise might not be able to survive the treatment, if the harmful effects of the air vitiated by massive dosage of x-ray and high tension discharges could be eliminated.

In this unit the air which was acted upon by rays or which was subjected to the action of electric field is removed through a flexible rubber tube to the exterior. In the end of the tube box there is an air filter through which dried and dust-free air is aspirated into the tube shield. The suction apparatus re-



quired for this purpose can be placed anywhere, such as, for instance, in a closet or another room, and its noise can be diminished to such an extent that it can hardly be heard.

While thus all the principal requirements are very completely solved, the dimensions of this shield are by no means cumbersome or such that it is difficult to manipulate it. This shield is mounted upon a carriage which is supported on ball bearings, running on

tracks alongside the table. The shield, located on top of this carriage, revolves on ball bearings in all directions. It also can be tilted sideways so that any practical angle required for deep therapy can be obtained without the necessity of manipulating the weight of the tube and shield. Furthermore, the patient is at all times fully protected against the high tension circuit, not only through the shield, but also through the grounded metal structure of the brackets, which is always between the

tube terminals and the patient. To place the patient on the table the entire holder is pushed to one end of the table and the patient is then fully accessible for adjustment from three sides. Then without any effort the shield is rolled into position over the patient and adjusted to the proper angles and tilts. The height of the tube above the table is easily adjustable between heights of twenty-four and forty-four inches above the top of the cushion on the table.

High Tension Intermediate X-Ray Unit

A RADICAL departure from the usual method of rectification in x-ray apparatus is inaugurated by the High Tension Transformer and Equipment Company of Hoboken, New Jersey.

Examination of the interior view of that company's Intermediate Unit, as shown in the accompanying illustration, discloses that by means of a rotary wave selector injected into the primary circuit instead of across the secondaries, that company is able to build a machine much more inexpensively than is ordinarily the case. The rectifying apparatus under this plan, it will be observed, is very much smaller—indeed, one of the striking features of this Unit is that the entire rectifying mechanism is operated by a one-thirtieth horse power synchronous motor.

The argument advanced in justification of this theory of construction is that it is much more simple and inexpensive to rectify the primary current,

at 220 volts for example, than to deliver that voltage to the transformer, step it up to 220,000 volts, and rectify the latter high potential with its consequent load on the transformer. There is this to be said of this method: It practically eliminates corona and static accumulation in the field of inducted energy, delivers a uni-directional current to the transformer, and permits much simpler and less costly construction.

So far as is perceived at the moment, such a plan of construction ought not only to be feasible and practicable in radiography and fluoroscopy, but also advantageous. There are a number of conditions known to every experienced radiologist which might conceivably be eliminated in this kind of work by having the rectification occur on the primary instead of the secondary side.

In the case of therapeutics, however, there is not sufficient information at hand at the moment to determine how,

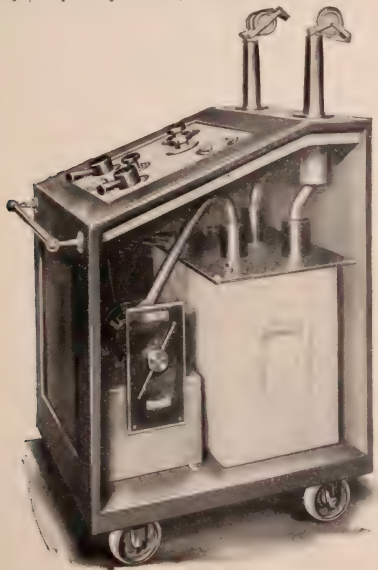
under this method of construction, it is possible to control the character of the wave actually delivered to the tube. Due to the question of lead and lag incident to the magnetizing and demagnetizing processes of the transformer, some serious questions are suggested, because it is vitally imperative in therapy work to definitely determine and control the character of the wave delivered into the tube in order that x-rays of the desired character and length may be produced.

Workers with this kind of apparatus will undoubtedly be interested in knowing exactly what effect the High Tension Company produces by its peculiar method of construction on the characteristics of the wave on the secondary side delivered into the tube, through the introduction of a rotary wave selector into the primary circuit. As they will also be interested in knowing the details of construction by which an absolute control of wave characteristics, so essential to therapy work, is established.

Without attempting to answer these questions, or to set up the biological facts involved in the problem, the suggestion is made that perhaps the High Tension Company has developed some plan, the result of its exploratory work, by which these features are adequately provided against; or that, if it has not, that perhaps their solution can be found by the introduction of a simplified rotary wave selector across the secondary terminals as well as in the primary circuit.

The Journal will be pleased to receive and publish information on this phase of the discussion.

The capacity of the Intermediate Unit is five milliamperes at a nine-inch gap. The unit is operable either on a 110 or 220 volt alternating or direct supply from the ordinary light socket. The complete unit consists of radiographic table, tube stand, tube shield, Coolidge tube (universal type) and the transformer. On the latter will be found calibrated spark-gap control, primary voltage control, and a simplified polarity indicator.



ABSTRACTS *and* REVIEWS

A Radiological Study of the Appendix, in Chronic Appendicitis. C. Jaisson, Jour. de Rad. et d'Electr. Vol. 5, page 256.

I.—RESULTS of study of the normal appendix show:

- 1—The appendix fills simultaneously with the cecum, about four hours after the ingestion of the meal.
- 2—There is a clear filling at least twelve hours after the meal, when the large intestine is completely visualized, and the rectum is partially filled.
- 3—At twenty-four to twenty-eight hours emptying and segmenting of the appendix begins and changes in position and form may result from its movement.
- 4—After thirty-two hours some residue is still to be found in the proximal portion, but none in the distal.
- 5—In the normal appendix filling takes place in a relatively short time, the emptying process takes a longer time.

II.—Findings in a chronically diseased appendix.

Characteristic Physical Signs

- 1—Uneven filling in repeated observations.
- 2—Kinking or curling of the appendix.
- 3—Shadow of the appendix appearing without bismuth filling, usually signifying calcification of the appendix or containing fecal concretions.
- 4—Vacuoles in the filled appendix.

Functional Signs

- 1—Immobility of the appendix resulting from inflammatory adhesions.
- 2—Tenderness not uncommonly found in an atypical location.
- 3—Delayed emptying about three days or more, in the normal thirty-six hours.
- 4—Exaggerated movements and strong segmentation of the appendix are of doubtful significance.

These observations were made on children. Two thousand three hundred gms. of barium meal was given in three hundred cc. of milk, after complete bowel emptying.

A. M. P.

Tuberculosis of the Stomach. Paul Biernath, Deutsch. Med. W., No. 37, page 1091.

SIX cases of apparently primary tuberculosis of the stomach have been described in the literature. The author observed a seventh one.

A widow of thirty-eight has had stomach trouble for thirteen years. For the past five months she suffered of flatulence, anorexia, constipation (contrary to the usual diarrhea), vomiting, and pain independent of meals or posture, and marked loss of weight. X-ray examination showed an hour glass stomach with marked narrowing of the lower third of the lesser curvature. Operation resulted in complete cure. Pathological examination revealed the tuberculous nature of the ulcer.

As the general and a thorough pulmonary examination for tuberculosis was negative, and as three injections of tuberculin after the operation were negative, the condition is assumed to have been a case of primary tuberculosis of the stomach.

A. M. P.

Radiological Studies of the Internal Organs of the Newborn. E. Vogt, Berliner Klin. W., Nr. 20, page 513.

THE studies are based on thirty-nine cases in which radiological observations have been made.

The living newborn has a barrel-shaped thorax, the ribs proceed in a horizontal direction, the upper thoracic opening is at right angles with the spinal column, the sternum stands high, and the epigastric angle is obtuse. This form is not rigid, but depends upon the function of the chest organs.

The lungs fill with air from below upward, earlier in the maturely born than those born prematurely. Very frequently the only cause of death in the premature is a persisting fetal atelectasis.

To examine the finer lung structures in a prematurely born of one thousand three hundred gms. weight after death, the author injected the respiratory tract with an opaque solution, which showed the open bronchial tree through the bronchioles down to the alveoli. A section of the hardened lung proved to be particularly interesting for study.

In medico-legal cases where it is necessary to determine whether the child had an extrauterine life, radio-

logical examination should be used to complement the floating test. Roentgenograms of infants who never breathed show no internal organs, of those who breathed only for a short time a little air shows in the stomach and small intestine, and those who breathed actively for a considerable length of time show the lower lung portions filled with air. The form of the thorax is also significant, as the still-born child retains the intrauterine pear-shaped thorax.

The heart appears to lie crosswise. Characteristic is its globe shape and its proportionately large mass. The heart of the newborn is 0.89 per cent of the total body weight, while it is only 0.52 per cent in the adult. The thymus appears as a light asymmetrical shadow. The author remarks at this point that the thymic stridor has been treated successfully with roentgenotherapy. Congenital thyroid enlargement is often accompanied with enlarged thymus. The diaphragm shows up sharply.

Of the abdominal organs the stomach shows up best. Its axis is parallel with the body axis. The pylorus is to the right of the midline, and is elevated above the greater curvature. With breast feeding the food remains about two hours in the stomach, but in artificial feeding the emptying time is longer.

The liver occupies a large space in the abdomen. It projects from the costal arch and reaches to the level of the navel. It covers portions of the stomach. The small intestine contains some air and upon ingestion of the opaque meal a fine wave can be observed. The colon is rather long, the cecum lies in the right iliac region, the ascending colon makes an obtuse angle with the transverse colon at the hepatic flexure, and the transverse with the descending colon make an acute angle at the splenic flexure. The haustral formation is the same as in the adult. The descending colon reaches over the mid-line and makes many loops. The free mobility, the long meso-colon, and the loop formation bear some relation to the rise of Hirschsprung's disease. The ampulla recti and pars analis of the colon are easily recognized.

Of special interest is the stereoscopic examination of the injected arterial system. The blood vessels and capillaries are of wider caliber, due to low blood pressure. Particularly wide in caliber

are the vessels going to the brain. The umbilical arteries were found to be fully pervious to injection the first few days. The strength of their walls were about the same as those of the common iliac. In all injected specimens the pulmonary artery was clearly outlined, which proves that the ductus arteriosus Botalli remains open for some time.

The kidneys are seen in their normal location. The right kidney is only slightly lower than the left. The embryonal lobulation of the kidney is evident in the injected preparation.

A. M. P.

The Action of Radiotherapy on Tumor Albumins in the Serum. Loefer, M. Debray and Tonnet, Compt. Rend. des Seances de la Soc. de Biologie, Vol. 85, page 279.

THE observation that the serum of cancer patients is particularly rich in albumen, and especially in globulins, leads us to the assumption that this increase is the result of processes which bring about a resolution of tumor cells.

Radiation of inoperable tumors of the colon, stomach, liver and breast up to eighteen H in two-thirds of an hour under normal intake of food and fluids, showed an appreciable increase of albumen in the serum on the second day, and a very marked increase on the third day. Of the various albumens the globulins were chiefly marked.

Simultaneous investigation of the pepsin and amino acids in the blood serum showed a decrease of the erepsin titre, as well as of the other products of albumen metabolism.

A. M. P.

Pneumoperitoneum in the Diagnosis of Echinococcal Cysts of the Liver. F. Partsch, Deut. Med. W., Vol. 47, page 923.

A NUMBER of cases of echinococcus cysts of the liver, studied in the surgical clinic of the Rostock University during an epidemic in 1920, lead to the following conclusions regarding the diagnosis of this condition.

In case the cystic enlargement of the liver is not palpable, if the cyst lies posteriorly or under the diaphragm, in absence of compression phenomena (ascites, icterus) or of secondary involvement of the diaphragm and pleura, we only have the findings of an eosinophilia and the usual x-ray examination. Sometimes the diaphragm is bound up by adhesions or held high, but the frequent complication of pleurisy obscures the field.

In two cases a sickle formation of the barium filled stomach gave the clue to the existing cyst. Inflation of stomach and colon did not give satis-

factory evidence. The only satisfactory and reliable evidence was furnished by the pneumoperitoneum x-ray examination. The following evidence was obtained:

1—Changes of contour by projections of the cyst walls.

2—Changes of transparency. As the liver tissue is congested the cystic areas appear more translucent. In no case did the author observe any calcific deposits in the cyst walls.

3—Presence of adhesions.

4—A number of free air filled spaces are noticed to intervene between the liver surface and the diaphragm, and also between the former and the anterior abdominal wall. It is due to the fact that the uneven surface of the cystic liver cannot be applied against the diaphragm or abdomen.

5—It is differentiated from metastatic nodules by the fact that the latter is usually denser than the rest of the liver tissue. In the latter case the liver shows a much greater irregularity of the surface, and has no adhesions.

Contraindications are chiefly those of intra abdominal disturbances, such as meteorism, tension of abdominal walls, possible perforations, and heart disease. All the cases were performed successfully, and the author thinks pneumoperitoneum a very valuable diagnostic procedure if carried out properly and carefully.

A. M. P.

The Physical Foundations of Deep Therapy. Albert Bachem, Ph. D., Frankfurt, Germany. J. Radiol., April, 1922.

THIS is a paper dealing with Professor Dessauer's methods of deep ray therapy, worked out at Frankfurt University, Germany.

Dessauer's law of homogeneous radiation includes both a qualitative and a quantitative homogeneity. By qualitative homogeneity is denoted a mixture of rays consisting of wave components which do not materially change when penetrating the deeper parts; by quantitative homogeneity is meant absorption of the same amount of rays in different depths of tissue.

Dessauer was the first to point out that when raying with homogeneous radiations the problem was simplified by estimating the transmitted, not the absorbed, energy for the study of biologic effect. To do this the law of absorption as well as scattered radiation must be considered along with other things, e. g., the size of the field.

Since water has the same power of absorption as human tissue, Dessauer made his experiments in a water phantom. The absorption factor, for water, is 0.14 to 0.18. The three variable

factors are distance, size of field and quality of ray. With these the distribution of rays in the radiated medium was studied. Some unexpected results were revealed by this method, e. g., parts protected from the direct rays receive quite a large amount of radiation through scattering from the part radiated.

With the charts made in this study an exact plan of treatment may be formulated. The original article is illustrated with fifteen of these charts. The charts and tables worked out in this research are soon to be published in the English language. The author illustrates how the treatment is worked out for a carcinoma of the uterus having an invasion of the parametria and metastases in the lymph glands along the bony walls of the pelvis.

Similar charts have been constructed to study the action of radium radiation. These also are based on the erythema skin dose, and by a combination of charts the combined treatment with radium and roentgen ray may be arrived at.

In conclusion it is stated that it is possible to ascertain in advance, by physical means, the quality of rays furnished by any apparatus and also the time required to produce an erythema skin dose, the penetrability of the ray and the proper filtration. The multiple small field method of x-ray therapy must be replaced by the large field method to prevent the loss of the therapeutically important scattered radiation.

Treatment of Focal Infection of the Throat by X-Ray as Compared with Surgical Removal of Tonsils and Adenoids. W. D. Witherbee, M. D., New York City. Journal of Radiology, April, 1922.

THE predominance of lymphatic and embryonic tissue in both forms of tonsil, the tonsil consisting mainly of the former and the small fibroid tonsil consisting mainly of the latter, and the fact that these types of tissue are more easily destroyed by the x-ray than any other tissue is the principle of the author's method.

Cultures made from the tonsils after raying bear out the opinion that they have been rendered sterile. A series of diphtheria carrier cases (Hickey) gave eighty per cent free from the bacillus after two to four deep rayings.

The technique used by the author is as follows: seven inch spark gap, five milliamperes, four minutes time, ten inch distance and three mm. aluminum filter. The position and angle of the patient and tube corresponds exactly to that employed in making a radiograph of the lower molars. The number of treatments is usually about eight

given at intervals of two weeks, both sides of the head exposed at each treatment.

The x-ray method of treating chronic focal infection of the throat, namely, tonsils and adenoids, is not only safe and permanent, but will more thoroughly and completely remove this focal infection than any other method, surgical or otherwise, yet devised. Furthermore, the contraindications for operation in no way interfere with this form of treatment and there are no complications providing the technique is faithfully carried out. Freedom from burns also depends upon this factor.

There is no danger to the parotid, the thyroid, the pituitary or other glands.

The X-Ray Diagnosis of Accessory Sinusitis. James Gerritt Van Zwaluwenburg, M. D. Am. J. Roentgenol, January, 1922, page 1.

It was Dr. Van Zwaluwenburg's belief that x-ray diagnosis of sinusitis has not been as widely employed as it should be, owing to the fact that it is a task beset with unusual difficulty. He wrote the above paper in the hope that this situation might be remedied through relation of his experience in dealing with this phase of disease at the University Hospital at Ann Arbor.

He advocates in this paper the application of old principles, but the adoption of a simpler and more comprehensive technique. He considered the following requirements to be essential to success:

1. The structures of the nose and of all the sinuses should be demonstrated at a single routine examination.
2. Opportunity should be offered for the direct comparison of symmetrical parts.
3. Since the confusing shadows of the structures of the base of the skull and the cervical spine cannot be obviated by any one position or projection, sufficient differentiation of these structures should be offered, that their shadows may be recognized and separately appreciated and evaluated.

The technique which meets these requirements has several important though not new features. It provides for a strictly sagittal projection, covers all of the region under examination at one time, demonstrates satisfactorily the structures of the nose, and depends upon stereoscopic vision to differentiate the petrous portions of the temporals and the cervical spine and to lift them out of the region that is the subject of special study.

"Everything depends upon the fineness of detail in the posterior portion of the field. This can be accomplished only by the fine focus radiator type of tube." The thirty ma. tube was found unsuitable; instead was used the ten ma. radiator type, loaded to eight ma. under a tension equivalent to about five and one-half or six inch back-up spark. "A long cone with a small diaphragm is employed providing a circle of illumination on the plate not exceeding five inches in diameter. The patient lies prone with the forehead in contact with the plate changer, which is inclined at an angle of twenty-two degrees from the horizontal. The position of the focus spot in the sagittal plane is determined by a line passing from a point just below the outer canthus of the eye through the external auditory meatus and upwards. The head is fixed by a thin pad of cotton, which is covered by an aluminum hemisphere and held in place by the pressure of the cone which is lowered upon it. The exposure time is approximately two hundred and forty m.a.s. For the second plate of the stereo set the tube is moved cephalad two and one-half or three inches."

Stereoscopic vision depends directly on the sharpness of definition and this can be attained only by using a very small focus spot at a considerable distance and with a narrow cone. The importance of this cannot be overestimated.

The plates must show the lateral processes of the atlas and axis and the tip of the odontoid process, which should lie in the mid-line and not reach above the lower third of the septum of the nose. The position used throws the long axis of the ethmoid labyrinth almost directly in the line of vision, but the greater brilliancy of the stereoscopic image is depended upon to distinguish the position of the shadows.

Chronic sinus infections are sequelae of pre-existing disease in the nose and teeth and infections once started may be prolonged by nasal pathology, therefore the nose must receive as much attention as the sinuses.

In acute infections of the sinuses the cells appear denser than the normal owing to replacement of air by denser material, but unfortunately in the small cavities so little is added to the density that little trace is left on the plate.

Purulence leads on to extensive sclerosis and osteoplastic changes in the bony septa and walls of the sinuses—hypertrophies and increased densities result and interfere with the drainage, thus a vicious circle is established. On the other hand, the process may result in polypoid degeneration and the effect on the plate is entire occlusion of the

upper nasal passages, with an abnormally free space below the level of the lower margin of the middle turbinates.

The fact that the purulent type leads to deposition of bony tissue in the subperiosteal layer and the hypertrophied type leads to osteoporosis is of marked interest. Dr. Van Zwaluwenburg's experience was that true polypoid disease is more commonly general than limited in its distribution. The exact relation of the purulent and the polypoid types is still unsettled—a nice problem which the writer believed the roentgenologist must aid greatly in solving.

The chronically diseased sinus is relatively small in size. Acute sinus infections are frequently bilateral, thereby depriving the roentgenologist the advantage of comparison with the normal, but it is seldom that his aid is needed in diagnosis of acute infection. However, intra-nasal conditions that predispose to chronicity may be demonstrated and here the effort of the roentgenologist may aid the surgeon.

In acute polypoid disease the case is sometimes one of polypoid degeneration of the mucous membranes from the beginning. These invariably escape detection by the x-ray, perhaps because of a compensatory loss of density in the bony wall of the affected part.

In acute purulent sinusitis the signs are an osteoplastic process in corresponding chambers and contiguous portions of the nose and frontal bone. The process is usually unilateral, there is a greater density in the affected region and the outlines of the individual cells are well marked. Group infections are the rule. The contiguous portions of the nasal wall, especially the root of the middle turbinate, partake of the sclerosis. In the antrum the diffuse opacity of the entire chamber is probably due to retained exudates in part, but mostly to the thickening of the antrum and posterior walls.

The general opacity is not so striking in the ethmoidal group and comparison with the opposite cells in comparable position will aid in determining the increase in density. It is necessary here to differentiate from hypertrophy of the turbinates. Solitary infections of the ethmoids are uncommon. Changes in the turbinates are usually absent. Except as a complication of frontal sinusitis involvement of the anterior ethmoids is rare.

In the frontal sinus the main reliance for diagnosis rests upon the condition of the infundibulum, which invariably shows distinct changes. "Satisfactory plates will show this structure beside the lateral walls of the upper nasal fossa except when they are entirely normal.

The infundibular walls are early thickened and the cavity obscured."

The sphenoid normally has walls that are paper thin "and the cavity is strikingly clear. When infected the increased thickness of its wall is conspicuous and the general density is much increased. The distinction between a sphenoiditis and the occurrence of an intranasal opacity as a polyp may be extremely difficult."

Associated involvements will give a clue in trying to locate the site of chronic purulent disease.

"Differential diagnosis must take into consideration the rare cases of failure of aeration of the accessory sinuses and the persistence of cancellous bone throughout life. This is most frequently seen in the maxillary and presents a very confusing picture." Uniform distribution of shadows, smaller size of the maxillary on the affected side and the failure of a definite cortical layer on both sides of the relatively thin wall of the normal antrum all aid in the recognition of this condition.

The appearance of the plate in poly-poid diseases of accessory sinuses contrasts markedly with the above description of the purulent types. Osteoporosis of the bony walls and exclusion of air by an overgrowth of mucous membrane are the marked features here and destroy in the plate the differentiating details of the normal cavities. The process varies with the chronicity of the disease, it is usually bilateral and symmetrical. "The distinction between this condition and polyps secondary to the purulent type of the disease and the fibromata and myxofibromata arising from the mucous membranes of the nose must be sharply drawn."

The structural changes in bone described in this paper do not regularly follow acute sinusitis, nor even repeated attacks if of short duration. During intervals of freedom no appreciable changes will be found, as a rule, though the writer questioned whether entire freedom from infection ever exists after a chronic attack unless operation has intervened. The situation he compared to a chronic and a latent appendix.

The surgeon, failing to find infection during a period of freedom, may consider treatment unnecessary, but this is one of the times the roentgenologist should insist upon the value of his findings receiving recognition. The more serious difficulties with the surgeon arise in the earlier stages of the disease. "A certain degree of difference is essential to helpfulness. Differences of opinion may be adjusted, but differences of observation must be explained. If the problem can be approached by both in a spirit of mutual respect for the observations of the other, both must

profit by the study of their differences in opinion, with ultimately a closer approximation to the truth on the part of both."

The Alveolar Radiogram. Joseph A. Pollio, M. D., San Francisco, Cal. Jour. National Dental Assn., January, 1922, page 36.

THE alveolar process is or should be the real object of the radiogram, for upon the condition of the bone beyond the root depends the next therapeutic step. "Alveolar radiogram" is therefore a preferable term to "dental radiogram."

No other part of the body is so difficult to accurately radiogram as is the mouth, and the demonstration of the changes around the teeth requires more than good films, correct exposure and proper angles; good radiograms depend upon three fundamentals—experience, equipment, and the dark room.

The dark room "is the most prolific source of technical artefacts." It must be absolutely light proof. The time of development, temperature, the ingredients of solutions, and the methods of development are of the utmost importance.

Proper illumination has been a grossly neglected factor. To study a radiogram by window light necessitates that the radiogram be made darker than it should be, and thereby minute yet very important details are erased.

The future of dental radiography depends upon the consistent demonstration and recognition of early disease changes in the teeth and their alveolar processes, but these things will never become routine until good radiography is demanded, and it never will be demanded until dentists have been taught what good radiography is, what it should show and upon what principle it depends. It is not advocated that dental students become radiographers, but something more should be taught them of this work in order that they may demand what their patients are entitled to.

The uncertainty that exists as to the value of radiography in dentistry is not due to the radiogram, but to the kind of radiography. The dentist should be enabled not only to decide upon the extraction or the retention of a tooth, but he should be enabled to recognize disease before it has spread far enough to become a problem.

Too often only gross lesions are recognized, too often exact knowledge of the normal is lacking and therefore true knowledge of the pathological cannot exist—but nevertheless in an appalling number of cases the plate is

interpreted under just such limitations.

The normal alveolar process has irregular cancellations (due to the haphazard way the lamellae are arranged and united) and harmonious blending of the lights and darks, which is due to the balanced distribution of calcium salts. The normal strands of bone tissue will show as thin delicate white lines inclosing dark or black irregular areas (the cavities) and no matter how old the patient may be this irregularity persists in health, though in the older cases the strands will be more distinct because of a greater percentage of calcium salts. Whenever this cancellated structure becomes *regular*, *ill defined* and *homogeneous* then pathological processes are taking place. Diminution of calcium salts will allow the rays to pass more freely—result, a darker spot in the film and vice versa. Areas of old extraction are by no means all normal and may be the source of focal infection.

The normal tooth has two structures, the peridental membrane and peridental lamellae, the relationship of which is distributed by the slightest pathological activity and therefore acts as a guide in interpretation of the radiograph and determination of therapeutic measures.

The peridental membrane shows as a fine, even, black line (because it is a soft tissue) outside of the cemental border of the tooth and slightly thicker at the cervical border. The peridental lamellae (the author objects to the terms, "cribriform plate," "linea dura," "lamina dura," "stratum durum") is a thin layer of compact bone immediately beyond the peridental membrane and forms the outer edge of the alveolus. It has numerous openings for the attachment of the fibers of the peridental membrane. Normally it has the same thickness all the way around and fits the tooth perfectly. It is the closest bony structure in relation to the tooth and lies between the tooth itself and the alveolar mass. Any pathology within the tooth before it can reach the cancellous portion of the alveolar process must alter or destroy the peridental lamella; it accomplishes this by first attacking the peridental membrane, which then hypertrophies and pushes out the peridental lamella, making it sag. A thickening of this fine black line anywhere indicates an inflammatory process.

To repeat, radiograms should be inspected for irregularity of cancellations, harmonious blending of lights and darks in the bone, the fine black line and the fine white line around the tooth.

The *Pathological Meaning of Radiographic Variations in Density*. Radiographic variations may be ana-

tomical or pathological. The anatomical have been described above.

Many teeth are daily extracted because the meaning of a radiographic alteration in density is not understood. If the variation in the radiogram is due to excessive occlusion the tooth can be retained with proper remedial measures, but if it is due to infection satisfactory retention is very doubtful.

No one influence shows a specific radiographic abnormality. The same influence may produce radiolucence or radiopacity. Alveolar lesions due to severe chemical reagent may, radiographically, present the same appearance as a so-called apical abscess.

Harmonious blending of the lights and darks depends upon balanced distribution of the calcium salts and this depends ultimately upon nutrition of the part and this may be modified either by lessening it or increasing it.

Lessening nutrition induces absorption of the lamellae, which are replaced by connective tissue and vessels of various form. This diminishes resistance to the passage of the rays, therefore increased radiolucence results and the film shows a dark spot. Disease, excessive use, trauma, chemicals, pressure and bacteria may bring this about, but which one of these is the responsible agent cannot be judged from the changes in the structure.

A morbid increase of nutrition results in the deposit of more lamellae and therefore in radiopacity. The underlying cause may be infection, mechanical trauma or excessive occlusion, thermal shock, defensive reaction and an unknown influence producing a dense compact bone change which has no Haversian system.

Eburnation is the only true exostosis found around the teeth. Exostosis (due to osteoblastic influence) is different than hypercementosis, which is a cemental process and a term often misused.

The following radiographic classification is given of dental changes, which in the main are grouped into three classes:

I.—Dentulous Localized Alveolar Atrophy:

- 1—Disuse—teeth have no opponents, bone atrophy increases radiolucence.
- 2—Mechanical Trauma — excessive or hyperocclusion, lateral oftenest affected and cyst often present.
- 3—Chemical—disintegration from harsh reagents and filling material in root canal therapy.
- 4—Pressure — pericementomata (apical abscess, granuloma and hockey), cystic pericementoma, and true cyst (any area which

has dissolved the bone to an extent of three-eighths of an inch in the radiogram is probably cystic).

- 5—Bacterial—any area of increased radiolucence around the apex and at some part in either the distal or mesial margin of the tooth root, and having a regularity of loss of cancellations, probably belongs to this type.

II.—Dentulous Localized Alveolar Hypertrophy:

- 1—Infective — bacteria enmeshed in layers of lamellae, unless the exciting factor is removed the bone continues to accumulate until it produces serious symptoms through pressure upon some vital structure, e g., inferior dental canal.
- 2—Mechanical trauma—often explains a stubborn alveolar absorption.
- 3—Thermal shock—before pulp degeneration has occurred, after that is atrophic so the inner part gives increased radiolucence and the other increased radiopacity.
- 4—Defensive—secondary to atrophic infective process, may produce impingement.
- 5—Unknown — producing eburnation, very rare.

III.—Edentulous Areas: First pointed out by Joseph Novitzsky in 1918, and sadly overlooked:

- 1—Atrophic—
 - (a) Chemicals—used after extraction.
 - (b) Pressure — from retained pericementoma and cysts.
 - (c) Infective — retained root fragments, poor surgery, lowered local resistance.
- 2—Hypertrophic—
 - (a) Infective—bacterial activity persisting after extraction.
 - (b) Defensive — reaction against bacteria in a retained area of infective atrophy.
 - (c) Eburnation — often overlooked because of its very hard structure and because extraction was done without radiograms taken.

Tumors are classed between the atrophic and hypertrophic divisions in the dentulous and edentulous headings. They may be manifested by radiolucence and by radiopacity.

The Use of the Fluoroscope for Reducing Fractures. G. L. McWhorter, M. D., R. A. C. S., Department of Surgery, Rush Medical Col-

lege, Chicago, Illinois. Med. J., February, 1922, page 102.

THERE is slight recognition of the value of the fluoroscope in reducing bone fractures.

Its use is indicated in all types of fractures in which there is any deformity or where it would be an advantage to secure better alignment.

The majority of cases can be safely transported to the x-ray room after the injured part is immobilized. Roentgenograms for detailed inspection are first made in two planes. These two views will usually determine the amount of the deformity and give the relations of the bony parts.

The patient is then placed upon the fluoroscopic table—a general anesthesia will be necessary in a majority of badly deformed fractures, though occasionally a local anesthetic or even morphine alone will do. Some form of permanent splint and bandage is made ready and then under actual fluoroscopic examination the reduction is accomplished. The parts are examined in all planes possible to get the best results in reducing and the permanent dressings are applied, using great care not to disturb the alignment.

If plaster of paris is used, while it is hardening, observation under the fluoroscope is continued and any slight deviation from alignment corrected. A surprisingly short time is taken to reduce even difficult fractures. The advantages are summed up as follows:

- 1—Anatomical approximation of the fragments may be most perfectly obtained.
- 2—Fewer manipulations are necessary.
- 3—Less trauma results to the fractured ends and to the soft parts.
- 4—Avoidance of prolonged or increased hemorrhage.
- 5—Complications such as injury to nerves or large blood vessels avoided and danger of myositis ossificans lessened.
- 6—All angles of observation may be secured.
- 7—The neighboring parts are at the same time put in the best position for repair.
- 8—Repeated reductions avoided also many open operations. If operation necessary it is discovered at once. The parts are in the best possible condition for repair and healing.
- 9—Poor or fair results avoided.

Epithelioma of the Face and Their Treatment with Radium. Howard Mann, M. D., and Lawrence Taussig, M. D., San Francisco. Arch. Dermat. & Syph., January, 1922, page 72.

AFTER the age of forty years epitheliomas make up a large per-

centage of all chronic facial lesions. Basal cell epitheliomas and the squamous cell epitheliomas are the two main classes of facial skin cancer. The former is the more common type, occurs oftener in men than in women, and is clinically subdivided into the following classes: the rodent nodule, the superficial ulceration, the deep ulceration, and the cicatrizing variety.

The great majority of these facial epitheliomas have been associated with seborrheic keratoses and may run for years before showing malignancy, or malignancy may develop shortly after their first appearance. Chronic irritation, the author believes, has but little influence in developing malignancy, but becomes a factor afterwards.

The very extensive lesions with or without bone development are the most difficult to treat, and their successful eradication necessarily involves resultant deformity. When situated in the canthus some form of treatment is demanded which will not eradicate the lid. The majority of dermatologists now admit that in most cases of basal cell epithelioma radiotherapy alone or in combination with curettage is the treatment of choice. The time which this takes is the only disadvantage; the advantages are painless application, small resultant scar and as few recurrences as from any other mode of treatment.

In the extensive cases radium is the only satisfactory form. If the bone is involved curettage should precede radiotherapy, which is then applied to produce a shallow bone necrosis. After removal of the resultant sequestrum, and healing, plastic surgery may be employed. A constant lookout must be maintained for recurrences.

In treating a superficial rodent ulcer a full strength plaque, screened with a rubber dam only or with 0.1 mm. of aluminum is fastened over the lesion for a total dose of from three to four hours divided between two or three successive days. If the lesion is relatively deep then from 0.3 to 0.5 mm. of brass is employed as a screen and the time increased to five or six hours. In the rare cases when tubes are used the dosage is roughly forty millicurie hours per square centimeter of surface so distributed that there is one tube to each square centimeter. The usual screen is 0.5 mm. of silver and one mm. of rubber tubing. With buried tubes the dosage should not exceed one or two tubes of 0.5 millicuries each augmented by screened applications to the surface later on. Severe reaction beginning about the seventh day and extending to the fourteenth day may be expected with any of these methods. The edges of the rodent ulcer must be thoroughly irradiated. The advantage

of radium over roentgen ray is that the reaction from the former heals eventually without undue scarring, whereas disastrous after effects may follow the use of the latter.

Epithelioma of the ear is very difficult to treat. Surgical treatment gives poor cosmetic results and intractable action has been reported following radium. The writer states that he has found this reaction to be severe, but that it clears within a reasonable time and results have been good. The technique is similar to that for other superficial lesions except that a thicker screen and relatively longer time should be employed. Buried tubes should be used only in very extensive and fungating cases. Regional lymph nodes should be irradiated with roentgen rays unless positive that the lesion is of the basal cell type.

In lesions of the lip a deep tight keratosis clears promptly and permanently under adequate radium treatment. A half or full strength plaque of sufficient size to cover the lesion is screened with 0.1 mm. of aluminum and applied for a total of two to three hours. Early epithelioma of the lip with palpable, mass and apparently limited to the superficial structures can be readily cured by surface applications in plaques or tubes. With the plaque a full strength application screened with 0.1 mm. of aluminum and a total dose of four to five hours is given in two to three sittings. If the tubes are used a screen of 0.5 mm. of silver and one mm. of rubber is employed, giving from forty to fifty millicurie hours to each square centimeter. Cervical glands should be watched for some time after treatment and prophylactic treatment given if necessary.

In more extensive lip cases surgical removal with dissection of the regional lymph nodes "is usually satisfactory, but for a number of reasons it may be desirable to treat it with radium" and in this case, in addition to the surface treatment given superficial cases, two to eight bare tubes of 0.5 to one millicuries each should be buried in the tumor and the lymph glands of the neck irradiated with the roentgen ray or a radium pack. With the roentgen ray is used sixty milliamperes minutes at a ten inch skin distance, with a ten inch spark gap and five mm. aluminum filter applied to each of three areas every three or four weeks for three or four times. If a radium pack is used then three thousand to four thousand millicurie hours at three centimeters filtered through two mm. of lead may be used on each of three areas every four or five weeks for three or four times. Palpable nodes should be surgically removed a week or two after

the first irradiation and the areas subsequently irradiated again. Very extensive carcinomas of the lip are equally hopeless under radiotherapy and surgery, though palliation is secured in some cases by conservative radiotherapy.

In the treatment of basal cell carcinoma of the face it is seldom necessary to employ buried tubes; surface application, except in very extensive cases, is usually satisfactory. In the majority of squamous called carcinoma buried bare tubes in conjunction with surface applications have been very helpful. In the treatment of deep carcinomatous infiltrations buried tubes are almost a necessity.

Radium in Cancer of the Bladder.

George Gilbert Smith, M. D., F. A. C. S., Boston, Surg. Gynec. & Obst. November, 1921, page 570.

THE treatment of cancer of the bladder by surgery has given satisfactory results in only a small proportion of cases.

The Huntington Hospital in Boston began the use of radium on their cases in 1916, and from September, 1916, to January, 1921, twenty-four cases were so treated. Fifteen of these had been operated on before and nine were judged, after cytoscropy, to be unfit for operation. There were no benign papillomata in the series.

Two types of treatment were used, the earlier one employed screened radium emanation applied to the interior of the bladder, attempting to apply it as closely as possible to the region of the tumor. The later type of treatment employed bare emanation tubes or else steel needles implanted directly in the tumor.

From a study of these cases it is concluded that four hundred millicurie hours given with a screening of 0.5 mm. or one mm. of silver may be used without any very marked reaction. If suprapubic drainage is used greater doses may be employed, and if urine is entirely excluded from the bladder one thousand millicurie hours cause no discomfort.

The duration of reaction is from four to six weeks with moderate treatment. If no reaction has developed in three weeks after the first treatment the second one may be given then.

Hemorrhage and cystitis decrease after a single radium treatment. Large infiltrating carcinomata involving large portions of the bladder wall cannot be cured, but superficial cancers may be reduced. However, if the tumor begins to grow again, further treatment with radium has little effect.

Implantation of bare emanation tubes in the tumor—one to each cubic

centimeter, is the best method. Steel needles may be employed the same way, but must be withdrawn after adequate exposure. The necrosis caused by the implantation of radium in the bladder tumors persists at least three months.

Value of Pneumoperitoneal Roentgenography in Obstetrics and Gynecology. Reuben Peterson, M. D., Ann Arbor, Mich. Jour. A. M. A., February 11, 1922, page 397.

EXTENSIVE employment of this method during the last eighteen months at the University of Michigan Hospital leads the author to say that the safety of the method has been established without a doubt.

He seeks to give an answer to the question "What is the value of this method as a diagnostic procedure?"

Out of three hundred and twenty-five cases in which this method was employed only those operated upon after gas inflation (one hundred and thirty-eight) are here considered.

Just how these roentgenographic diagnoses were made was explained in Dr. Van Zwaluwenburg's paper in the March Journal of Radiology. Every patient was gone over pro and con prior to gas inflation and if any doubt existed the procedure was decided against.

By mutual agreement between the author and Dr. Van Zwaluwenburg, the roentgenologist, the diagnoses were arrived at independently by each of the two men, and the author concedes it to be remarkable in what proportion of cases the roentgenologist, who was working in a practically new field and without knowledge of the clinical histories involved, gave the correct diagnosis.

The roentgen ray report was afterwards gone over in connection with the clinical findings and the operation decided upon or decided against.

In fifty-four cases of salpingitis the clinical diagnosis was correct in thirty-three cases, or sixty-one per cent and the roentgenological diagnosis correct in twenty-four cases, or forty-four per cent. In the remaining cases the roentgenological diagnosis was partially correct in twenty-one cases and incorrect in nine cases. It must be kept in mind that the roentgenologist arrived at his diagnosis by the roentgenograph alone, with no help from the clinician's findings or the patients' histories.

From this experience it is deduced that the pelvic roentgenogram, plus a careful bimanual examination, is the next best method to direct palpation and in time, with added experience, may be almost as effective.

In early pregnancies (sixth to the tenth week) the pneumoperitoneal method has been exceedingly valuable, the condition being positively diagnosed in eight such cases with no knowledge of history or findings.

Other pelvic conditions, such as fibroids with and without diseased appendages, small pelvic growths, unruptured ectopic pregnancies, etc., have been diagnosed by this method, but times does not permit the discussion of these.

The pneumo-peritoneal roentgenogram is an invaluable aid and the author states that its use would be abandoned with the greatest reluctance in his clinic.

Treatment of Acne. Cosby Swason, M. D., Atlanta, Ga. Southern M. J., January, 1922, page 27.

THE treatment of this disease has always been unsatisfactory. The acne bacillus is found in nearly every skin and predisposing causes develop it. In one thousand and twenty cases treated by the author in the past ten years the conditions named below were found present in the percentages given: Aggravated form of seborrhea

of scalp.....	50%
Constipation.....	45%
Gastro-intestinal trouble in some form.....	42%
Diseased and enlarged tonsils.....	40%
Infected teeth and gums.....	22%
Other skin diseases.....	8%
Rheumatism, so-called.....	7%
Dysmenorrhea.....	5%
Syphilis.....	1.5%
Nephritis.....	1%
Pulmonary tuberculosis.....	0.75%
Malaria.....	0.50%
Enlarged thyroid.....	0.20%

Each patient has to be dealt with according to symptoms present. Focal infection, constipation, menstrual disturbance, urinalysis and diet must all receive appropriate attention. Local treatment is not to be lost sight of.

The author has found that x-ray gives the most beneficial and lasting results and would be reluctant to treat these patients without it. The majority of cases showed good results after three or four treatments and some of the most severe cases showed striking improvement. The effect is upon the sebaceous glands, which offer least resistance than other skin structures.

The usual quantity given is one-fourth skin unit every seven days for five or six exposures, then every fourteen days for five or six exposures. Under or over exposure brings undesirable results. The eyes and hair must be screened with lead foil when giving treatments of the face.

The Treatment of Carcinoma of the Prostate. John H. Cunningham, M. D., Boston. *Bost. M. & S. J.*, January 26, 1922, page 99.

THIS paper touches upon the clinical course of carcinoma of the prostate and upon diagnosis and then passes to the treatment.

"Too much emphasis cannot be placed upon the importance of the pathological examination of all prostates removed, because a recognition of the condition (of malignancy) calls for post-operative treatment with radium, if we are to do everything to prevent a local recurrence of the disease."

If a suspicion of carcinoma arises during pre-operative examination a complete x-ray examination of the entire skeleton is advised as bone metastases are not uncommon. Metastases of the lungs will also be revealed by x-ray, though this may not be so in the abdominal nodes and organs.

The author is not optimistic of cure by any means in carcinoma of the prostate, but believes that life may be prolonged and relative comfort procured by the combination of radium and surgery, or by palliative measures with radium alone, or this combined with bladder drainage when surgery is out of the question. "It is today generally admitted that the radical operation as a curative means is futile, because, even with complete removal of the local disease, the metastasis remains."

As to radium the author is "convinced that it has much value, chiefly in preventing local recurrences if employed before and at the time of operation, and subsequently employed following the operative convalescence."

Two leading views were held at a recent meeting of the American Association of Genito-Urinary Surgeons. One view holds that surgical procedures dealing with the malignant gland tend to favor metastases by opening channels for dissemination. Its adherents advocate radium alone, and with suprapubic bladder drainage if necessary. The other view is that as much of the malignant gland as possible should be removed and radium implanted in the prostate area followed by local radium applications later. Favorable local results were reported by both schools.

The author separates his cases, broadly, into two groups. One group in which the patient has symptoms dependent upon prostatic obstruction and whose general systemic condition will permit surgical intervention—and the other group in which the same general symptoms are present, but for whom surgery is not possible.

In the first group as much of the gland as possible is removed, even including the seminal vesicles in some cases, and sometimes the prostatic sheath. From five hundred to one thousand millicurie hours of radium, according to the amount of the growth left at the time of operation, are left in the prostatic area, and about three weeks following operation, daily radium treatments of one hundred millicurie hours are given through the rectum, bladder, and urethra for thirty days.

The second group are subjected in some instances to the "Punch" operation with subsequent radium treatment, or, suprapubic drainage is followed with radium needles, which are introduced through the suprapubic opening and left implanted for from five hundred to one thousand millicurie hours, with subsequent treatment of the gland by radium therapy through the rectum, urethra and bladder.

Still another group includes those with few distressing symptoms of prostatic obstruction and those with local recurrence of the disease following operation. This group is given radium treatment alone or combined with catheterization and irrigation to relieve a residual urine and bladder infection.

The radium treatment is a combination of the methods of Barringer and of Young—the Barringer method supplemented by that of Young about three weeks after the needling. The daily applications of radium for one hundred millicurie hours are introduced into the prostatic region through the rectum, urethra and transvesically in the ratio of three rectal to two urethral to one bladder application, according to circumstances, and never applying radium to the same area on successive days. At the end of this course of treatment the gland and perhaps the seminal vesicles are again needed by the Barringer method. Examination is made again in about a month, catheterization and bladder lavage being carried on in the meantime. Relief of symptoms and diminution in the size of the gland is not to be looked for until several weeks after the course of radium treatment.

"The course of treatment as outlined is essentially that employed at the Mayo Clinic, where results are classified as:

- 1—Relieved of all symptoms.
- 2—Growth shrunken, but some urinary obstruction.
- 3—No change.
- 4—Remarkable results and apparent local cures.

The results in Young's clinic are classified as:

- 1—Actual beneficial results (diminution in size, softening of the car-

cinomatous gland with relief of retention in most instances.)

- 2—Symptomatically improved: diminution in frequency of urination in about sixty per cent, relief of local pain in seventy per cent, cessation of bleeding in all cases where a factor; five per cent of the patients of four years are without a return of local symptoms.

The author's cases, on the whole, he has found symptomatically and locally improved, with some apparent local cures. While not covering as large a number of cases as those clinics just referred to the results have followed along the same lines.

Carcinoma of the Prostate. B. S. Barringer, M. D., F. A. C. S., Dept. Urology, Memorial Hospital, New York City. Jour. S. G. & O., February, 1922, page 118.

THIS paper deals with the diagnosis and treatment of carcinoma of the prostate and a report to date is given of the cases of carcinoma of the prostate treated by radium at the Memorial Hospital.

The gross pathology, types of malignancy, frequency of growth beyond the prostate, prostatic carcinoma secondary to bladder carcinoma, early symptoms, routine and pathological examination are discussed. The technique of radium apparatus which has been in use in this hospital since October, 1915, is described as follows:

Prostate Needle: A steel needle, ten to fifteen centimeters long, number eighteen gauge, is used and upon the end of it fifty to one hundred millicuries of radium are placed in the end terminal (three centimeters). Under novocaine, guiding by a finger in the rectum, this is inserted through the perineum into one of the prostate lobes; for the other lobe the needle is only partially withdrawn from its position in the perineum and then inserted into the other lobe. A carcinomatous mass two centimeters in diameter will stand three hundred to four hundred millicurie hours. In two to three months a smaller dose may be given. In some cases three-to-five to fifty millicurie hours every week have been given.

Seminal Vesicles: These are radiated routinely if the size of the prostate does not prevent their being reached. They are sometimes reached through the rectum (after first cleansing this with soap and water) by inserting a small cannula up to the vesicles and inserting a needle through the cannula, thus reaching the vesicle.

Bare tubes in the prostate and seminal vesicles have been used, both in the prostate and in extensions beyond the prostate, but are not so efficacious

as the needles, and besides are more painful.

Urethral: The use of radium in the prostate urethra has been limited to cases in which the carcinoma has directly invaded the urethra. Tubes of screened radium (rubber one mm. silver 0.6 mm.) two centimeters long are attached to a linen thread and inserted into the bladder through the sheath of a urethroscope, which is then removed and the tubes pulled out into the prostatic urethra by the attached thread. When the treatment is finished the tubes are pulled out of the urethra. Two hundred millicurie hours is the maximum dose. This may be varied by using a silver tube of radium in the end of the urethral catheter.

Rectal: Screened radium in the rectum is used in only a few cases, as it is more painful and not so efficacious.

Residual Urine: In most cases increase of this can be prevented and in a few cases a decrease can be brought about by the needle method. If this produces no effect and the symptoms warrant it, one of the following methods is employed: (a) a bare tube of radium (six millicuries) is placed in the end of a flexible needle and this, by the aid of the McCarthy urethroscope or the Buerger operative cystoscope is plunged into the prostate at the lower part of the bladder neck, the bare tube is punched out of the needle by a plunger into the prostate and left there. (b) If the residual urine does not reduce after this method the Young punch operation or suprapubic drainage with suprapubic partial prostatectomy is resorted to. The ideal procedure in intractable cases has not yet been found.

Pain caused by the growth of the carcinoma around the pelvic or spinal nerve has rarely reacted to radium or x-ray.

Swelling of the legs, caused by pressure of the carcinoma on the common iliac vein has been successfully combated by the radium pack placed over the abdomen and centered on the vein (ten thousand to fifteen thousand millicurie hours).

Rectal Stricture: In one case two bare tubes of five millicuries, were inserted into one segment of the stricture, being inserted through the rectum. They relieved constipation and in one case a colostomy was thereby avoided.

The writer submits a number of case reports and draws these conclusions:

- 1—In but two per cent of the cases of carcinoma of the prostate seen at the Memorial Hospital is the carcinoma apparently confined to the prostate.

- 2—Routine prostate examination of all patients, beyond the age of fifty

and irrespective of symptoms, is the only rational method whereby an early diagnosis of carcinoma of the prostate can be obtained.

3—The results of radium treatment of carcinoma of the prostate are superior to operative removal, both in causing regression and in coping with urinary retention.

Our Problems. O. H. McCandless, M. D., Chairman's Address, Section on Radiology, Southern Medical Association, Annual Meeting, Hot Springs, Ark., November, 1921. Southern M. J., January, 1922, page 17.

THE intelligent use of the x-ray necessitates co-ordination of other diagnostic and therapeutic effects.

"There is unquestionably a toll of disability and mortality from attempts to correct morphological changes and exaggerated functions that are largely compensatory. * * * A wide range of familiarity with compensatory phenomena necessitates an intensive study of the whole field of medicine. Bone changes and other anomalies cannot always be correctly diagnosed without a knowledge of the common endocrinopathies. The significance of calcium and its distribution, the distribution of gas in muscle tissue, emphysematous and pneumo-visceral phenomena, whether bacterial, traumatic or spontaneous, and the significance of exudates and transudates have a bearing upon prognosis and diagnosis, or both.

The time element, if nothing else, prevents the surgeon being equally proficient with the x-ray, and the knife, else he might be his own roentgenologist; on the other hand, the roentgenologist who thinks that x-ray alone will enable him to render reliable diagnosis will soon defeat himself. Both the training and experience of the roentgenologist "should be such that he may stand gracefully firm in his report when it is warranted, yet be humbly conservative in the great number of conditions in which the x-ray has shown a percentage of error."

The really great problem of the roentgenologist is how to promote cooperative efficiency.

The technician is a problem or not, accordingly as he (or she) works under a competent medical man or puts forth his efforts in another field, unfortunately legitimate in many of our states, where any cult or "ism" may diagnose and give medical advice under the guise of a commercial x-ray laboratory.

An independent state radiological association has served a good purpose in many localities.

The constant influx of new apparatus presents an increasing debt to the physicist and demands increasing skill on the part of the man using it—and even the competent man can and does sometimes make mistakes. New problems in therapy arise with the advent of the new apparatus.

Post-roentgen nausea is as yet an unsolved problem. The spinal cord and supra-renal bodies are thought by some to play some part in this. Dr. Orndorf believes that removal of all body covering from the patient lessens the nausea.

Post-mortem study greatly aids in the acquirement of knowledge by the roentgenologist and should not be overlooked by him.

An elaborate discussion of the above mentioned problems might be made, but time did not permit of that in this paper.

The Roentgenologic Diagnosis of Gastric Ulcer. Russell D. Carman, M. D. Southern M. J., January, 1922, page 20.

THE roentgen ray is not a competitor of the microscope in diagnosis, as it only discloses the presence of a tumor, ulcer, or lesion of uncertain character.

Nearly all neoplasms of the stomach are cancerous. There are three gross types of gastric cancer, namely, the medullary, the scirrhous and the mucoid or colloid. The first is characterized by large, soft, lobulated or cauliflower-like masses projecting into the lumen. Scirrhous cancer infiltrates the stomach wall with a hard dense tissue, but the neoplasm does not project markedly into the gastric cavity, but gives rise to contraction. Mucoid or colloid cancer is related to the scirrhous type, but masses of gelatinous tissue are found instead of the dense scirrhous type.

Ulceration may considerably alter the fundamental characteristics of gastric cancer (hyperplasia and tumefaction). Some of the malignant ulcers cannot be roentgenologically distinguished from benign ulcers.

The Carman technique is as follows: Sixty grams of thoroughly cooked cereal mixed with sixty grams of barium sulphate (with sugar and milk if the patient cares for it, but no cream) are given instead of breakfast. Nothing else except water is permitted until after the examination has been made.

Six hours after this the patient is fluoroscoped while standing and with most or all clothing removed and the advancement of the six hour meal is noted. The patient is now given one hundred and twenty grams of barium sulphate, fourteen grams of sodium bi-

carbonate and ten cc. of syrup of raspberry in two hundred and fifty cc. of water, all very thoroughly mixed. The cardiac portion of the stomach is observed while the patient is drinking and then the stomach as it fills. After the patient has finished drinking the peristalsis is watched.

By manual pressure the contents are forced upwards so that the cardiac end is well outlined—the duodenal bulb is also demonstrated in like manner. The general form, outline, tone, position, mobility and flexibility of the stomach are all observed and the patient turned at various angles. He is also examined supine and prone on the trochoscopes if a lesion in the cardia is suspected. Two or more plates are then made with the patient prone and the tube at the back. It is important that the examiner be in the darkened screen room fifteen to twenty minutes before the examination.

The roentgenologic signs of cancer are:

Altered Motility—

1—In nonobstructive cases—

(a) Exaggerated initial clearance, the gaping pylorus.

(b) Hypermotility of the six hour meal.

2—In obstructive cases—

(a) Scanty or absent initial clearance.

(b) Six hour retention.

Altered Peristalsis—

1—Absence of peristalsis from involved area.

2—Weak peristalsis (in nonobstructive cases).

3—Exaggerated, irregular peristalsis and antiperistalsis (in obstructive cases).

Lessened flexibility in involved portion of the gastric wall.

Lessened mobility with extension of growth to tissues outside the stomach.

Alteration of size (capacity) of stomach—

1—Shrinking (non-obstructive, scirrhous).

2—Dilation (of uninvolved portion of stomach above obstruction).

Persistent local spasm. Incisura opposite lesion (occasional).

Displacement of stomach. Upward and to left by scirrhous cancer.

Meniscus, sign of some ulcerating cancers.

Large niche ulcer (occasionally).

"Consonant with its gross pathology the tumor-producing cancer of the stomach has for its chief and indispensable roentgenologic sign the filling defect." There are various simulants of filling defects. It must remain constant in form and situation despite manipulation and antispasmodics.

Gas or fecal matter in the colon, secretion in the stomach, spasm, spinal pressure, extensive tumors, ascites, ovarian cysts and pregnancy may produce apparent filling defects.

Hypermotility is a common characteristic of cancer unless obstruction exists, in which case emptying is retarded. In non-obstructive cases peristalsis is generally diminished and may be totally lacking if involvement is extensive, and is usually absent in the invaded area. Exaggerated peristalsis in the region above the growth is often present in obstruction cases.

Unless the growth has extended to adjacent tissues mobility of the stomach is not impaired. Diminution of flexibility of the gastric wall in the area invaded by the growth is often discovered, scirrhous cancer especially stiffens the wall.

"Like every other diagnostic test, the roentgen ray is not infallible. Sometimes it overlooks; sometimes it misinterprets. Notwithstanding these difficulties and occasional lapses, the roentgen ray will usually discover cancer as early as the patient's symptoms drive him to seek medical advice.

"I would particularly stress the fact that the roentgen ray will show a cancer earlier than the most thorough clinical examination. This is not said in disparagement of clinicians. * * * The service of the x-ray is increasingly invoked and improves constantly in efficiency."

X-Ray Work in Country Practice.

Charles D. Enfield, M. D., Louisville, Ky. J. Iowa S. M. S., February, 1922, page 44.

THE general practitioner in the small community is handicapped in many respects through lack of expert roentgen consultation and advice. In these communities, remote from the advantages of well organized clinics, the need for roentgen diagnosis is just as great, except in numbers, as in the larger communities.

It is impracticable and undesirable that the general practitioner should attempt to acquire the highly specialized skill of the expert roentgenologist, but the writer believes that a certain amount of training will yield valuable returns to both the community and the practitioner himself, for in at least twenty per cent of the cases coming to him for diagnosis, exclusive of fractures, the aid of the roentgen ray is needed.

The war brought about great advances in the design and manufacture of x-ray equipment, so that now a simple plant may produce high grade roentgenograms. This is the simplest and easiest part of the problem and can

be soon mastered by any medical man. The interpretation of films and of the images on the fluoroscopic screen is a different problem and the ability to successfully do this can not be "picked up", nor can it be learned from books alone. The writer advises that several weeks be spent in some clinic where there is an abundance of material and an expert roentgenologist in charge who will aid in the study of interpretation. Such a method will give a perspective for later independent work and frequent return visits will give the general practitioner a wholesome respect for his own limitations. Without adopting this method any attempt by him to make use of the x-ray will only be detrimental to the patient, himself, and the whole field of roentgenology.

The field of roentgen therapy must, except for the most superficial treatments, be left to the experienced roentgenologist. The possibilities of danger are too many and too great for a novice to enter it.

Concerning Radiation in Pelvic Cancer. Albert Soiland, M. D., Los Angeles, Cal. Southwestern Med. February, 1922, page 47.

THE writer believes that favorable operative risks should receive the benefit of the best surgical skill, but when this is not feasible there is no excuse for withholding radiation.

There is no cure by any means for unmistakable cancer of the uterus, but distinct benefit may be derived from radiation. Carcinoma of the cervix may be cured in a certain proportion of cases. Border line cases should be radiated and treated just as carcinoma.

The writer's technique for cervical carcinoma "consists of an implantation in the cervix of fifty milligrams of radium element, with filter of one-half millimeter of brass and one millimeter of hard rubber, for fifteen hours, giving four such applications within six days time. * * * This treatment is followed by x-radiation over the lower abdomen through four ports of entry."

In cancer of the body of the uterus the technique is practically the same, except that radium is carried up to the fundus if possible. If this can not be accomplished, radium is packed in an additional two millimeters of hard rubber filter, the rectal wall is protected with two millimeters of lead and the entire mass inserted into the posterior cul de sac, additional tubes are placed in each fornix, and the exposure carried up to six thousand milligram hours in six days time. The x-ray cross fire is directed through six ports of entry on the abdomen, giving a total of nine hundred milliamperes minutes with ten

millimeters aluminum filter, one-half inch cotton filter, under compression, one hundred kilovolts, five milliamperes tube circuit at an eight inch skin distance."

Routine procedure of intra-uterine pre-operative radium application, operation following in five to seven days, immediately followed with radium in the vagina, x-ray over the abdomen in the usual post-operative way is advised by the writer.

Fractured Vertebrae. William B. Bowman, M. D., Los Angeles, Cal. Southwestern Med., January, 1922, page 13.

THIS paper is a plea for more careful and thorough examination for fractured vertebrae in back injuries. Before the day of the x-ray many compression fractures of the bodies and transverse processes of the vertebrae were doubtless often overlooked, for there is a class of fractured vertebrae which cannot be diagnosed by any other means.

In the writer's experience the following sites were more common in compression fractures, and they are given in the order of their frequency of occurrence: first lumbar, twelfth dorsal, second lumbar, eleventh dorsal, fifth lumbar, fifth and sixth cervical vertebrae. Some definite injury, e. g., striking the head while diving, was known to have occurred. He thinks syphilis may be a predisposing factor in these fractures.

Roentgenograms of the vertebrae should be taken in both the antero-posterior and lateral positions. Two roentgenograms at right angles to each other give more information than stereoscopic roentgenograms.

These fractures must be differentiated from tuberculosis, carcinoma, syphilis, infectious diseases of the spine and from congenital anomalies. The history is important here. In tuberculosis the bone destruction is not accomplished by proliferation or callus formation and fever is present. In carcinoma also there is bone destruction without proliferation, the pain is severe usually and there is a primary lesion elsewhere. In syphilitic spondylitis with carries the pain is worse at night, new bone formation is more marked than in fracture, and the periosteum is greatly thickened. In spondylitis deformans the bodies are asymmetrical and the lesion seldom confined to one vertebra. In the corners of the bodies are chronic hypertrophied changes with subsequent fusion. Failure of fusion of the laminae of the transverse processes, an extra or a lack in ossific center (particularly in the dorsal re-

gion) are congenital anomalies often mistaken for fracture.

In all severe injuries the writer would take at least one large roentgenogram of the spine and if a lesion were found would then take a roentgenogram of the affected area in every conceivable position. Duplified films with double intensifying screens will shorten the time of exposure, give greater detail in heavy parts and with the Potter-Bucky diaphragm will give clear detail in regions heretofore unattainable.

X-Ray Treatment of Tonsils with the Conjoint Use of the Ultra Violet Ray. A. J. Pacini, Director Burdick Research Laboratory, Washington, D. C. Jour. Radiol., April, 1922.

SURGICAL indications exist and should be utilized, but there is a class of tonsillar dystrophies where x-rays are eminently useful, and this is particularly true in hypertrophied tonsils in children, which is the phase of the pathology treated in this paper.

The author states that it is probable that the tonsils during childhood contribute to the establishment of an immunity and this must be taken into consideration in determining the line of treatment followed.

Speaking only of hypertrophied tonsils in children, there are three types of conditions found: (1) not excessively reddened tonsil, (2) obviously reddened tonsil but infection not clinically established, (3) markedly reddened and congested and infection clinically established.

In the first type hypo-activity will be discovered from careful observation and the treatment should establish some degree of activity, therefore surgery is not warranted and roentgenotherapy should bring the results desired, and it has brought brilliant results.

In the second type the tonsils appear to be playing a markedly active part and x-ray should first be resorted to before surgery is decided upon. The lack of success in roentgenotherapy of the second type is due to the fact, the writer believes, that it fails to correct immediately the acute infective exacerbation. The use of the ultra violet ray is advised here, for by this means the acute infection is quickly terminated and the clinical symptoms relieved.

In the third type purulent accumulations are the differentiating symptom, and by this is meant definite gatherings of pus in the crypts and spaces on the surface and in the mass of the glands. Here the x-ray and the ultra-violet ray are useless and surgery is indicated. The major immunizing influence of the gland has been lost through the effects

of pathogenic inflammation and it is no longer a useful organ.

Immunologic activity is characterized by the thriving of many organisms below the threshold of clinical infection; infection is characterized by the presence of one dominant strain of organism that has established an activity that no longer contributes to the physiologic manifestations.

The Mechanics of the Digestive Tract. Walter C. Alvarez, M. D., Assistant Professor of Research Medicine, George Williams Hooper Foundation for Medical Research, University of California Medical School. Octavo, Extra Cloth, 192 pages, twenty-two illustrations. 1922. Published by Paul Hoeber, 67-69 East 59th St., New York City. Price, \$3.50 net.

REGIONAL differences of behavior in the various parts of the entire digestive tract have been studied from the view point of the physiologist and the observations and conclusions drawn supply the subject matter of this book. An enormous amount of experimental work forms the basis for the theories advanced. It is a research work full of practical suggestions, however, for the practitioner.

With this preliminary description the chapter headings are sufficiently suggestive of the contents and are as follows: (1) The Autonomy of the Digestive Tract. (2) The Myogenic Nature of the Rhythmic Contractions and the Functions of Auerbach's Plexus. (3) The Smooth Muscle of the Gastro-Intestinal Tract. (4) The Different Types of Peristaltic Activity. (5) Gradients. (6) The Underlying Basis of the Rhythmic Gradient. (7) Other Related Gradients. (8) Graded Differences in the Stomach Wall. (9) Practical Applications of the Gradient Idea. (10) Reverse Peristalsis. (11) Objections and Difficulties. (12) Technical Methods and Apparatus.

The bibliography covers more than four hundred and fifty references to the literature and includes the names of several hundred authors from Hippocrates to the Mayos. This in itself is an index of the real labor which went toward the consummation of this noteworthy work. The index, covering eight pages, is divided into two sections, authors and subjects being separately listed.

Radiotherapy of Diseased Tonsils. Robert H. Lafferty, M. D., and C. C. Phillips, M. D., Charlotte, N. C., Jour. Radiol., April, 1922.

IT is about a year since radiologists in general began using this treatment.

As to the results noted in a survey of the field the writers state that while it is too soon to draw definite conclusions, there are some cases observed over a period of six years since the first treatment with no return of trouble. In no case has surgery been resorted to.

The first fifty cases treated by the authors fall roughly into four classes: (1) adults with large soft hyperplastic tonsils with deep crypts containing pus, (2) children with large infected tonsils and crypts, (3) adults previously operated but having part of the tonsil and scar tissue present, (4) adults and children who have had the entire tonsil removed and who have infected and enlarged lymph follicles in the pharynx.

The first class (twenty-nine cases) received an average of five treatments, no second series was necessary. The second class (eleven cases) received an average number of six and two-tenths treatments with perfect results in all but one case, who did not complete the treatment. The third class (four cases) improved with an average of eight treatments. The fourth class (six cases), showing generally an involvement of the entire Waldeyer's ring and a return of adenoids, gave apparently good results, but final judgment is reserved upon these, as is also a formulation of conclusions in general, until more time has elapsed.

The technique used in most cases was that recommended by Witherbee.

Organ Stimulation by the Roentgen Ray. William F. Petersen, M. D., and Clarence C. Saelhof, M. D., University of Illinois College of Medicine, Chicago, Ill. Jour. Radiol., April, 1922.

IT is probable that stressing the destructive effects of irradiation has contributed to the neglect in developing a field of roentgen therapy in the direction of selective functional tissue and organ stimulation.

The diametrically opposite effects of irradiation, stimulative and lethal, are well known. Functional stimulation of the organs of internal secretion was readily observed by the authors following moderate doses of rays and the data of such animal experimentation is given in the original article.

There are two methods of approach in the clinical application of functional organ or tissue stimulation, namely, the direct, in which stimulation of a hypo or disfunctioning organ is sought, and the indirect, which takes into consideration the fact that the roentgen shock is akin to a protein shock and has therefore, an *a priori* basis for therapeutic effects.

The Germans have collected a series of observations along the line of the first method. Stephan concluded from his experiments that methods which stimulate the natural forces to greater resistance to the invasion of tumor cells would be of more value than present methods. One of the most interesting of these researches was one concerning the pancreas by Stephan. Increased sugar mobilization, the author notes, has generally been found as a result of irradiation of the abdominal viscera.

Following this line of research by Stephan experiments were carried out by the authors upon depancreatized dogs and the general conclusion drawn is that with moderate doses of roentgen

rays applied over areas containing pancreatic rests there may result an augmentation of sugar excretion, followed by evidence of pancreatic stimulation with increased sugar tolerance lasting from three days to three weeks. Lastly, if the dose is too large or if a cumulative effect is produced there results a lowering of the sugar tolerance.

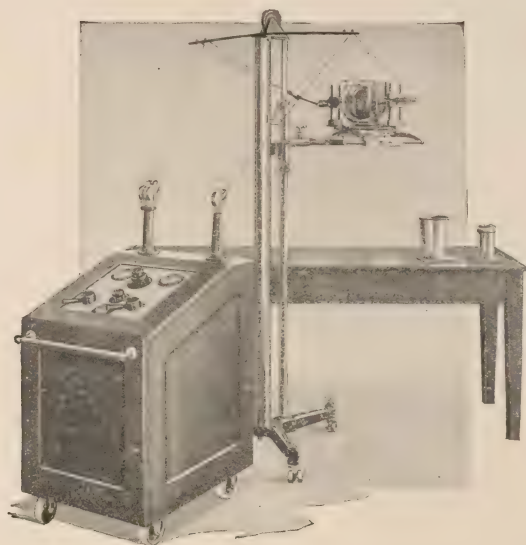
Conditions for this type of experiment are much more favorable in the dog than in the human diabetic subject—but even in clinical cases there is some evidence that a diabetic process may be influenced by direct radiation though treatment is not advised at present unless all other means are of no avail in diabetic coma.

The differences that may be determined in the serum when different organ groups are rayed for different time periods were also a subject of investigation. The hepatic, the splenic and the lower abdominal regions were selected for this. The leukocytosis following such regional irradiation varied, giving a sharp but transient rise in the hepatic area, a step-like rise in the intestinal area; in the splenic area a diminution of the white count was manifest. Coagulation changes followed after irradiation of all the areas exposed. Enzyme alterations were most marked after radiation of the hepatic and intestinal areas.



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Errors in the Roentgenologic Diagnosis of Duodenal Ulcer*

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Section of Roentgenology, Mayo Clinic
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LESS than a decade ago, at a time when the roentgenology of gastric cancer and ulcer had already gained definite recognition, investigation of the duodenum was considered impracticable. Today the diagnosis of duodenal ulcer is so thoroughly developed that the roentgenologist can discover the lesion with facility and with only a small percentage of error.

To discuss these errors may give a wrong impression, namely, that the diagnosis is attended with difficulty or that the roentgenologic findings are unreliable. Yet it is only by reviewing mistakes that we can learn whether it is possible to avoid them.

Laying aside the various minor and indirect signs of duodenal ulcer, there are but two trustworthy indications of this lesion. They are deformity of the duodenal contour, and the combination of retention and hyperperistalsis in a large but otherwise normal stomach. Hence, any mistakes should hinge chiefly on the elicitation or interpretation of these phenomena. The errors made are also of two classes—those of affirmation, when an ulcer is diagnosed but not found at operation, and those of negation, when an ulcer is not diagnosed, but is found at operation.

Among the causes of affirmative error are the following:

1. Technical errors and difficulties. Failure to fill the bulb completely. Retraction of the abdominal wall. Blending of the bulbar shadow with that of other portions of the duodenum or of adjacent concretions. Diagnosis on incomplete examinations.

2. Deformity of the bulb by causes other than ulcer. Reflex spasm or other inflammatory processes in the right upper quadrant. Extrinsic tumors. Pressure against the spine. Lesions of the duodenum other than ulcer: benign tumors, duodenitis, diverticulum and cancer.

3. Pyloric and prepyloric gastric lesions.

4. Overemphasis of minor auxiliary signs or bias by the clinical history.

Causes of negative error comprise:

1. Technical faults in the examination; insufficient milliamperage; improper voltage; unsuitable tube; too great distance of patient from tube; neglect of the examiner to prepare his eyes; failure to use the diaphragm; failure to examine both roentgenoscopically and roentgenographically.

2. Neglect to examine the duodenum in cases of cardiospasm, or ulcer or other lesion of the stomach.

3. Unfavorable position of the duodenal bulb.

4. Actual or apparent absence of bulbar deformity. Minute ulcers. Absence of spasm from the ulcer. Small but apparently regular bulb due to obstruction of the distal portion of the bulb. Nonobstructive ulcer beyond the bulb.

AFFIRMATIVE ERRORS

Adequate filling of the duodenum is absolutely necessary for the demonstration of its actual contour. When the examination is made immediately or shortly after the opaque meal has been given, a method which is in common use, an incompletely filled duodenum may be mistaken for one deformed by ulcer. Of the factors promoting complete filling, free opening of the pylorus is perhaps most important. Free opening is retarded by coarse particles of food. Hence, for the examination fluid mixtures are best. After trying various mediums I have found an aqueous mixture to be the most satisfactory.

Sometimes the bulb is difficult to fill because it is unusually capacious, and persistent efforts may be required. Occasionally a patient, especially one who is apprehensive, retracts his abdominal wall so strongly that the initial out-flow through the pylorus is scant, and the stomach cannot be satisfactorily manipulated to assist duodenal filling.

Manual pressure on the stomach, which I employ routinely, inclining the

patient to the right, examination in the right recumbent position, and blocking the lower duodenum with the hand or Holzkecht's distinator are all well known measures for assisting complete filling. David has employed the duodenal tube for this purpose. Notwithstanding all aids, satisfactory filling cannot always be secured.

Akerlund describes an occasional looping downward of the duodenum alongside the bulb and the combination as seen in certain projections may simulate bulbar deformity. He also mentions the shadows of gallstones or kidney stones merging with the shadow of the duodenum as a possible source of error. During roentgenoscopy it should be possible by palpation to separate and distinguish the bulb.

Caution against the diagnosis of ulcer after an examination that is lacking in thoroughness should be unnecessary. A positive diagnosis on bulbar distortion is warranted only by deformity which is constant, unvarying as to location, and virtually identical in appearance during the examination. If the examination is roentgenographic only, an ample number of plates should be made.

Spasm of the duodenum resulting from disease of other organs may produce deformity similar to that caused by ulcer. Notable among such diseases are cholecystitis and chronic appendicitis. (Fig. 1). Disease of the pancreas is a possible excitant of duodenal spasm. In one of our cases of cancer of the pancreas a persistent spasm of the bulb was interpreted as ulcer. Not infrequently spasm is associated with concurrent cholecystitis and pancreatitis. Renal calculi have also been suspected as a cause. Disease of the gallbladder or appendix is common in patients sent for roentgen examination of the digestive tract, and the symptoms often resemble those of duodenal ulcer. Fortunately duodenal spasm occurs only in a small proportion of these cases. Like gastric spasm from extrinsic causes it tends to change form and situation. In

*—Presented before The Radiological Society of North America, Chicago, December 7, 1921.

some cases that I have seen the spastic deformity was persistent and unchanging, and caused a mistaken diagnosis of ulcer.

Pericholecystitis and other inflammatory processes in the vicinity of the bulb may distort its contour by adhesions. (Fig. 2). Sometimes this deformity is constant, cannot be distinguished from that of ulcer, and is responsible for a considerable proportion of errors. Aekerlund is of the opinion that the deformity they produce is often characterized by fine shallow irregularities, sometimes variable, and different from the typical defects caused by ulcer. I have not as yet observed any dependable differential features of adhesions. It is to be remembered also that adhesions may result from a perforated ulcer. Deformity of the bulb is not an inevitable sequence of adhesions, as I have seen many patients in whom at operation the first part of the duodenum was found to be embedded in adhesions although the bulbar contour was quite normal in appearance. Very rarely, sixty-hour gastric retention and hyperperistalsis may result from obstructive pericholecystic adhesions.

Extrinsic tumors infringing on the bulbar contour are not common. They should usually be palpable and their presence thus be evident. The gall-bladder sometimes makes a smoothly curved indentation in the bulb, but this is apparently different from the irregular deformity caused by ulcer. Pressure against the spine may cause a bulbar filling defect. This can be eliminated by palpatory shifting during roentgenoscopy.

Benign tumors within the bulb are pathologic novelties. I have had one case in which the bulb contained a hemangioma. It appeared as a central filling defect in a large bulb of unbroken outline and the diagnosis of an

intraduodenal tumor was obvious. Aekerlund has seen a few cases of papilloma with similar signs and only one was diagnosed as ulcer. I have observed one case, diagnosed by the aid of the roentgen ray as ulcer, in which the surgeon found a diverticulum on an angiomatous base but could not determine whether an ulcer existed or not. In another instance a diverticulum was found opposite an ulcer which had been diagnosed, but diverticula occur more commonly around the ampulla of Vater.

Judd has recently called attention to an eccentric form of ulcer which he calls the duodenitis type, or submucosal ulcer. When excised the mucosal surface seems normal, but on close examination one or more pin-point ulcers are found, and the submucosa and muscularis are infiltrated. Spastic bulbar deformity is usually present in these cases just as in other types of ulcer. (Fig. 3). Designating this type of ulcer has no bearing on clinical diagnosis or treatment, but in the absence of induration and marked mucosal erosion a cautious surgeon might doubt the validity of the roentgen diagnosis. This consideration also applies to the occasional small ulcer which, after the abdomen is opened, shows no manifestations on the serosal surface, is not palpable, and is found only by incising the duodenum.

Cancer of the duodenum is among the rarities. Only five cases have been observed at the clinic in its entire history. None of four cases examined by the roentgen ray was mistaken for ulcer, and the growth was distal to the bulb in every instance.

Gastric lesions near the pylorus may be deceptive in various ways. Occasionally prepyloric cancer or ulcer does not visibly deform the antrum, and at the same time, if obstructive, gives rise to gastric retention and hyperperistalsis,

or the lesion may produce deformity resembling a distorted bulb, and the examiner may be unable to determine the exact site of the pyloric ring. (Fig. 4).

Error from stressing the subordinate signs of ulcer or being unduly influenced by the clinical history is scarcely excusable. Gastric hypertonus, hyperperistalsis (without retention), and hypermotility are not of themselves indicative of duodenal ulcer.

NEGATIVE ERRORS

Satisfactory roentgenoscopic examination requires attention to many technical details. If these are disregarded an ulcer may easily escape recognition on the screen. Two features are essential; the image must be clear and the examiner's vision must be adapted to the relative darkness. To secure a clear image the milliamperage and voltage should be appropriate, the tube should have a focus as sharp as is consistent with reasonable endurance, the screen should be of the best quality, the patient should be close to the tube and the diaphragm should be actively employed to narrow the field of observation.

In a case of cardiospasm the establishment of its diagnosis by the roentgen ray would seem to be sufficient, but I have been impressed by a few cases in which the condition was accompanied by duodenal ulcer. The relationship of duodenal ulcer to gastric spasm is well known and it is not unreasonable to suspect a similar connection with cardiospasm. At the clinic we now request that after dilation for cardiospasm the patient be returned for examination of the duodenum.

Occasional association of duodenal ulcer with gastric ulcer is a familiar fact. When the latter is found a careful search for a possible companion in the duodenum should ordinarily not be omitted. However, when the gastric

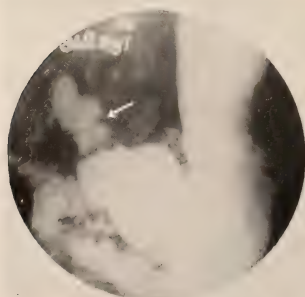


Figure I.—(Case A-342931)—Spastic deformity of the bulb, diagnosed as duodenal ulcer, in a case of chronic appendicitis.

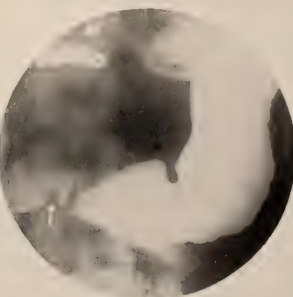


Figure II.—(Case A-363070)—Deformity of the duodenal bulb, associated with cholecystitis and adhesions. This deformity was diagnosed as duodenal ulcer.



Figure III.—(Case A-59961)—Duodenitis with spastic bulbar deformity.

ulcer is obviously of such character that perforation might result from manipulation, or when the patient is so weak that the examination is harassing, the examiner should be satisfied with the demonstration of the gastric ulcer alone. (Fig. 5).

A duodenum which turns backward from the pylorus and is overlapped by the antral shadow in the anterior view is much more difficult to examine than the erect cap. In such instances the stomach is usually of the steer-horn type, is swung more or less horizontally, and the pylorus lies well to the right. By turning the patient into the right oblique view, carrying it almost to the right lateral position if necessary, the cap can usually be seen.

It is a standard and safe rule that a duodenal bulb of normal outline negates the presence of ulcer. This is not absolutely true, for I have seen a few patients in whom the duodenal contour was apparently undeformed, but which at operation were found to have ulcer. Absence of spasm or minuteness of the ulcer may explain the lack of deformity. I have noted exceptional instances in which even an extensive perforated ulcer failed to distort the bulb as seen by the roentgen ray. On the other hand, a small ulcer with active spasm may be readily detected. The surgeon is sometimes puzzled by these apparent inconsistencies of roentgen diagnosis.

A small minority of ulcers are located beyond the bulb in the second or third portions of the duodenum. In such instances the contour is not altered and if the distal duodenum is deformed it cannot be distinguished ordinarily by the roentgen ray from the irregular outline produced by the valvulae conniventes. Unless stenosis results with its characteristic signs the roentgen ray will seldom discover the lesion.

SERIES OF CASES

To throw some light on the relative importance of each of these many sources of error I have canvassed our records for the twelve months ending June 30, 1921. During this period five hundred and twenty-two cases in which a diagnosis of duodenal ulcer had been made by the roentgen ray, went to operation. In four hundred and ninety-nine cases the ulcer was found by the surgeon; in twenty-three cases no ulcer could be demonstrated.

Of the twenty-three cases, eight were found to have disease of the gall-bladder or appendix, or both. In none of these was the duodenum organically involved, and it may be argued that the bulbar deformity on which the roentgenologic diagnosis of ulcer was based was the result of spasm from the extrinsic lesions.

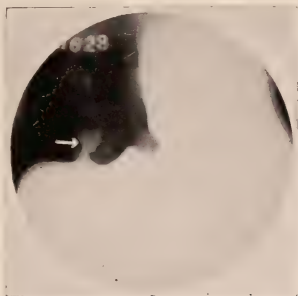


Figure IV.—(Case A-321623)—Carcinoma of the pyloric end of the stomach and of the duodenum. Roentgen diagnosis: duodenal ulcer.

Adhesions around the duodenum were responsible for the wrong diagnosis in seven cases.

Five errors were due to prepyloric lesions, cancer in three cases, ulcer in two. All of these lesions were near the pylorus. A cancer involving the liver, but whose origin was not determined, may have been the cause of the duodenal deformity in one case, and in another the lesion was a cancer of the hepatic flexure.

Thus, in twenty-two of the twenty-three cases there was definite justification for surgical intervention, and in two-thirds of them the lesion was in the right upper quadrant of the abdomen. In the remaining instance nothing could be found to explain the symptoms or diagnosis.

During the same period, of five hundred and forty-four cases in which a negative roentgen ray diagnosis was made, five hundred and twelve were confirmed by operation, and pathologic conditions other than ulcer were found. In the other thirty-two cases, or five and nine-tenths per cent, a duodenal ulcer was discovered at operation, although its presence was not shown by the roent-



Figure V.—(Case A-337234)—Concurrent gastric and duodenal ulcer. The gastric ulcer, the niche of which is seen at U, was diagnosed. The bulbar contour is normal.

gen ray. Some of these negative errors had no reasonable excuse other than the inevitable fallibility of the examiner. In twelve of the cases the organic changes as described by the surgeon seemed adequate to produce deformity recognizable by the roentgen ray. The changes included various combinations of induration, scarring and contraction, and in three cases perforation had occurred. As I have stated, rather marked organic alterations of the duodenal wall, even perforation, may exist without roentgenologic deformity, and possibly this was the case in some of the thirteen.

In eleven cases error was probably unavoidable. Eight of the ulcers were described as being small, one-half centimeter or less in diameter, and in the absence of spastic distortion would hardly have been visible. In one case the ulcer was in the second portion of the duodenum, six or eight cm. from the pylorus.

In the remaining nine cases duodenal ulcer coexisted with gastric ulcer. In eight of these the examiner discovered the gastric ulcer but either failed to observe any evidence of the duodenal ulcer, or did not look for it. Roentgenograms preserved in two of the eight cases show a normal bulbar contour. In the ninth case neither the gastric nor the duodenal ulcer was found by the roentgen ray. The gastric ulcer was small and on the posterior wall, but the duodenal ulcer was of the puckered type and should have been discovered.

SUMMARY

The principal causes of affirmative error in the diagnosis of duodenal ulcer in the order of their importance are reflex spasm, periduodenal adhesions and gastric lesions near the pylorus.

Duodenal spasm from extrinsic causes is most often associated with cholecystitis or chronic appendicitis.

Juxtapyloric gastric lesions may implicate the duodenal bulb or alter land marks so that exact diagnosis may be difficult.

Tumors of the duodenum, either benign or malignant, and diverticula are rare sources of error.

Confusion of the bulbar shadow with that of other parts of the duodenum or with the shadows of adjacent concretions is a technical fault which can usually be avoided.

The percentage of negative errors in this series slightly exceeds the percentage of affirmative mistakes. Many of these diagnostic failures are explainable by the absence of bulbar deformity, either organic or spastic.

Failure to diagnose a duodenal ulcer associated with a demonstrable gastric ulcer is not a grave oversight.

Ulcers situated beyond the bulb can hardly be diagnosed as such, although

obstruction may be demonstrable. They constitute a very small percentage of the total.

Many negative errors are avoidable. Some of them are due to technical faults, others are solely the result of careless observation and are indefensible. Perfection is admittedly unattainable, but the roentgenologist should not criticize himself too charitably.

In all that has been said there has been no intention to furnish an alibi for roentgenologic mistakes. On the contrary, although the mistakes of the roentgen ray in the diagnosis of duodenal ulcer are relatively few it is to be hoped that they can be further reduced. Assuming that examination is thorough and careful, the affirmative mistakes seem difficult to attack. Negative errors can doubtless be further lessened by technical precision and closer observation, so that fewer cases with actual bulbar deformity will pass unnoticed.

When one considers that the affirmative errors in this series amounted to only four and four-tenths per cent, and how difficult or impossible it is to diagnose the presence of adhesions or spasm due to extrinsic lesions, the wisest procedure for the roentgenologist is to diagnose duodenal ulcer when a definite, persistent deformity of the bulb is seen. The visualization of a well filled bulb, regular in outline, can mean nothing but a normal duodenum from a roentgenologic standpoint.

Finally, the question arises of supplementing the roentgenologic findings with the clinical data in order to make a correlated diagnosis and avoid occasional mistakes. However helpful the clinical facts may have been in the developmental stage of gastric roentgenology and however necessary they still may be for the interpretation of other roentgenologic findings, I believe that their employment at this time by the roentgenologist in the diagnosis of duodenal ulcer is unnecessary and would increase rather than diminish his mistakes. While the typical anamnesis of ulcer is admirably simple and clear, it is not pathognomonic, nor is ulcer always accompanied by a characteristic history.

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DISCUSSION

DR. FRANK SMITHIES (*Chicago*): It is not necessary for me to congratulate Dr. Carman upon this very splendid presentation of a difficult subject. I think the fact that he has made a special study of this type of failure in diagnosis indicates how important the subject has become in his own clinic and consequently how important it must be to us of lesser experience. Especially is this to be emphasized when we remember that Dr. Carman is dealing with a material which shows the maximum amount of duodenal deformity, namely a material which has been ill from ulcer or some abdominal complaint for an average time greater than eight years; a material which has passed through many hands, very likely, in an attempt to cure by non-surgical procedure some definite anomaly. It stands to reason, then, with the maximum amount of scar tissue, the maximum amount of obstruction such as this surgical material has, that the possibility of failure in that type of case, even, must be constantly born in mind. It also indicates that in those cases averaging eight years before reaching the surgical stage of ulcer, there have been greater possibilities for failure in diagnosis and that is particularly the group in which we are interested, not the group which is so ill and so abnormal that surgical procedures are advised by surgeons of eminence and discretion.

I am particularly interested in that group that comes before Dr. Carman's group, that group in which we may expect to have a great many more failures in diagnosis than Dr. Carman has indicated. That these failures occur is common experience to all of us.

What is the percentage of failure in diagnosis before large amounts of scar tissue have developed, before perforations have occurred, before adhesions have occurred? My experience—I am not a roentgenologist—is that the difficulties in the diagnosis of duodenal ulcer previous to the scar tissue stage are higher than Dr. Carman has indicated tonight. This should be emphasized, certainly before a special body such as this is. It would seem to me that the reasons for these failures are many. Certain of them cannot be avoided. There is not sufficient disease yet to produce the permanent deformity in one particular spot which Dr. Carman has emphasized. Furthermore, not sufficient attention is paid to the fluoroscopic examination in a properly prepared patient. All of us are quite familiar with the lack of preparation for roentgenologic examination of the average every day patient—

the failure to clean the lower alimentary tract.

White of Boston has clearly shown how a filled rectum, a filled large bowel, a filled terminal ileum has a particular and constant effect on the emptying of the stomach, and on duodenal and gastric peristalsis. It has been emphasized as to the subacute appendix or subacute cholecystitis, the rate of peristalsis or the spasmodic condition of the duodenum itself.

In 1918 I made a special study of the roentgenological side and of the clinical side and the surgical side associated with cholecystitis. We found that thirty-three and a third per cent of the instances of cholecystitis had spasm of the pyloric zone chiefly, but also of the second and third portions of the duodenum. These have been verified by Bryant of Boston. Anybody can then see how difficult it is to exclude these instances of cholecystitis with involvement of the pyloric zone by the roentgenoscopic examination.

Furthermore, it was shown at that time that in considerably more than fifty-one per cent of instances of ulcer of the duodenum and ulcer of the stomach we had cholecystitis coincident. It is evident how frequently deformity and abnormal rates of peristalsis or faulty emptying of the stomach may occur, due to the spasm from a cholecystitis.

In the cases where we have a great deal of scar tissue, it seems necessary to emphasize that these patients should not be condemned as having ulcer or not having ulcer upon one examination. If it is doubtful they should return very frequently for examination before condemned as having ulcer. They have a great dread of it. It is not as interesting to the patient as to the doctor.

We have followed a routine which has proved satisfactory. The records are made on the properly prepared patients after the fashion outlined by Dr. Carman. If there is a suspicion of duodenal disease or pyloric disease, these patients are thoroughly saturated with belladonna or atropin, usually over several days, and returned for comparative study. In this way it is possible to segregate from the subacute or acute ulcerations many cases, which at first might be considered as having real deformity, and class these as instances of lesions which are not ulcer.

In the group complicated by periduodenal adhesions Polesky of New York said the plate may be made with a duodenal tube in position; that one can by noticing the variation in the position or the curve or the angulation of this tube from time to time, with the patient in different positions, estimate how much fixation there may be in or

about the duodenum. A very simple means, one possibly as accurate, is a rather heavy string of cord saturated with bismuth or barium, which carries on the end a small slug. This will follow the tract of the duodenum quite as closely as Polesky's tube. Plates indicate very little unless they are made comparatively. They indicate little, indeed, in the ulcers not accompanied by great deformity. Serial plates indicate little unless different series are compared. Many times patients are treated for ulcer and everybody is disappointed when somebody comes along and takes out two or three gall stones, a foul gall bladder or removes an appendix. These points have come to my mind.

I will say in my own clinic and in my own mind the roentgen diagnosis of the non-deforming ulcer of the duodenum is an extremely difficult job. It is frequently impossible, and only when the roentgen findings are in association with thorough, careful, detailed clinical history, can we attempt to make a diagnosis. (Applause).

DR. BERTRAM W. SIPPY (*Chicago*): I am sure that I can say without fear of injuring the feeling of any one that, for obvious reasons, Dr. Carman knows more and should know more, and actually does know more than any one in the world about the roentgenological evidence of duodenal ulcer. We know that he is full of his subject. I would like to give my time to him. I know that he is willing to talk and I feel that he is not exhausted.

With this brief remark I expected to sit down. I would do so except for one thing, and that is that I must rise to the defense of accurate history, accurate study by other means than the roentgen ray to avoid error in diagnosis. It is commonly, among the surgeons particularly, stated that in the diagnosis of duodenal ulcer, clinical history comes first, roentgenological examination second, laboratory and other methods third and fourth.

When the laboratory methods consist in making a test meal, giving a test breakfast and determining acidity, a few little perfunctory things of that sort, we may agree that clinical history comes first, roentgenological examinations second and laboratory and other methods third and fourth.

In our work this is the way we look upon it. Of enormous importance is clinical history first, accurately taken. That clinical history becomes of great importance only when it is determined that the clinical history is correct and the man making it has observed accurately. This can only be done by a period of observation, which does not take long. The patients will not come

to you unless they have a distressed symptomatology.

If a history is obtained at this time by one who knows how to do it, then we place clinical history first, backed up by the conviction that the history has been given correctly, that it has been observed correctly. Then the clinical history becomes of enormous importance, of greater value in a great many cases than roentgenological findings.

In our work we do not have the x-ray examination made first. We get the clinical history. If there is nothing urgent about it, we study the case and determine whether the clinical history is right by having the patient under observation. If there is no contra-indication, and there seldom is, we give these patients three ordinary meals daily. We determine then whether distress is present. They won't come to you if the distress is entirely absent. When they come to you give them three meals a day, then observe whether the distress comes on immediately upon eating. If it does, it will rarely be attributable to ulcer. They may have distress in something else and still have an ulcer. It may come on at a period after eating. Distress to be attributable to ulcer does not come on immediately upon eating nor immediately after. When there is no obstruction present or perigastritis or other lesion to make the pain come earlier, it comes as a rule not much earlier than an hour or hour and a half after eating. When it appears it is a continuous distress. It may fluctuate in severity but seldom becomes intermittent. At the end of three hours it is not gone. It may continue until the next meal to be relieved by eating. This is observed accurately as to the time of appearance of distress. That is one of the most constant and reliable things we have to deal with in diagnosis.

I wish it were better known that when those symptoms appear they may be made to disappear under the influence of manipulations. They are so constant that when carefully studied there can be no incompatibility with certain things in relation to the symptomatology. We tried to bring that out briefly in Oxford Medicine if any of you care to know how we feel about it. We cannot talk about it here fully. There are five things that permit of no incompatibility: Epigastric distress of any sort, time relation to food taking, relief from adequate food taking. Often taking a cracker brings temporary relief. That may be permanent, but is seldom so. On taking a given meal consisting of an egg or two or steak or bread and butter with cereal, making two-thirds of an ordinary meal having

a good deal of albumin in it, the distress attributable to ulcer will be temporarily relieved for a period of an hour or two. The distress not relieved by food taking may not be attributable to ulcer. Distress is also relieved by adequate alkali. For a distress supposed to be ulcer distress, for adequate alkali test powder we use thirty grains of calcium magnesium and thirty grains of soda. Distress is relieved, and a distress unrelieved by that type of powder will rarely if ever be attributable to ulcer. Distress is sometimes present when the stomach should be emptied, say one or two o'clock in the morning. The patient says "I am awakened at one or two in the morning." A tube should be used at that time to see whether he has an adequate content to permit of that type of distress being due to ulcer.

When all of the clinical history runs true, if you find the man is having the usual distress, and you go in with the tube you will find he has the contents of the normal fasting stomach, that is, five, ten, fifteen, twenty cc. The man is sure that is his usual distress. This is one of the important symptoms of obstructive ulcer. That is what we mean by laboratory work, not simply taking the test breakfast, depending on the degree of acidity as to what is wrong.

I firmly believe that it is wrong teaching to separate accurate clinical study from the roentgenological evidence. I feel that the maximum benefit in diagnosis can be obtained only by a careful use of clinical signs in association with the best roentgenological findings. I would not speak if it were not to emphasize that point. I do not imagine that the cases go to the Mayo Clinic stamped as eight years old or older. I do not imagine they have to deal always with an old ulcer. Cases go to them as they come to us and to all individuals doing this work. They have no corner on the old cases. Therefore, what he says will be applicable to the type of cases we all get. They get the same cases we get. They are probably no different.

DR. WALTER W. HAMBURGER (*Chicago*): I enjoyed Dr. Carman's paper tremendously. I like particularly his method of study, his way of showing objectively his x-ray findings then checking them up with the surgical findings at the time of operation. That is an ideal way to study x-ray statistics. I feel as Dr. Sippy does. I do not want to take much of Dr. Carman's time. I want to emphasize the one point that both clinical and x-ray examinations should be made. I think perhaps it is wrong to make the statement, "Roent-

gen Diagnosis of Duodenal Ulcer." Is there such a thing? Would it be better stated to say "Roentgen Findings"? If the diagnosis is a clinical diagnosis of a clinical disease, physical findings, x-ray laboratory findings and at times history should be taken.

At my clinic, our procedure is a careful history taken as Dr. Sippy outlines careful physical examination, laboratory work and finally x-ray. As Dr. Smithies pointed out, controlling x-ray findings of same with atropin to be sure that the defects are not spastic but are organic.

Several years ago we were interested in the gross defects and relation of the gross defects of the duodenal cap to motility and influence of treatment. We proved later in operation that the clover leaf projections Dr. Carman showed are more scar tissue than granulation tissue or evidence of acute ulcer. The duodenal cap does not show whether the ulcer is active or whether there is simply scar tissue in the duodenal bulb causing those findings. Unless you correlate clinical evidence of activity of ulcer it does not make much difference whether you diagnose duodenal defect or not. It is not parallel with interference of motility. It may not interfere with the emptying time of the stomach.

The point was raised as to how many individuals without gastric symptoms of any sort might show duodenal defects, not relieved by atropin. I would appreciate it if Dr. Carman has anything to say along that line. It may be in some of his cases of positive findings with negative surgical findings they would fall into that group. Simple finding of cloverleaf forms without clinical evidence does not mean much.

I would be interested in looking through with x-ray a hundred individuals with defects we are calling ulcer. I want to say a word about the point I made, namely, that duodenal defects may not be associated with active ulcer. We have a few number of cases, somewhat, with a normal contour, which at operation showed a gross duodenal ulcer.

I am thinking of a man of fifty-five, a patient whose report I had published in North American Clinics a year ago. He had gall-bladder disease and a large duodenal ulcer in the posterior wall of the abdomen. We had no clinical evidence, and no x-ray evidence. These two conditions are mutually opposite. I would like to make that point clear. In the first group evidence of defect is constant under atropin without ulcer being present, without signs of activity, with no abdominal signs or complaints. In the other type the x-ray

shows a normal contour in the bulb and ulcer is found at operation.

I want to state my appreciation of Dr. Carman's paper.

DR. LEWIS GREGORY COLE (*New York City*): I was not on the program to discuss this subject, but it does give me the greatest amount of pleasure to corroborate every single statement that the speaker on this subject has made. (Applause). I think that he is attempting to do something which I do not believe that I can do. I have not tried to do it in the past and I do not believe I shall try to do it in the future.

There are approximately ten or twelve or perhaps fifteen per cent of the cases where we must content ourselves with a positive diagnosis of an organic lesion involving the cap.

The reports are worded in that form and then they go on to say that the deformity may be due either to the cicatricial contraction of the scar of an ulcer or to gall-bladder adhesions, the weight of the evidence being in favor of one or in favor of the other, and when we content ourselves with that, which I believe is a thoroughly practical statement, we will have eliminated all but three of the errors which Dr. Carman reported.

I would like to know of any other branch of medicine—I would like to know of any other method of examination, of any other disease, where the accurate diagnosis can be made in five hundred and twenty cases out of five hundred and twenty-three. (Applause).

Dr. Sippy and Dr. Smithies, I wonder, if by all other methods combined in clinical history and physical examinations, how happy you would be if in the years that had gone by or the years that come, you could make five hundred and twenty accurate diagnoses out of five hundred and twenty-three? (Applause).

DR. SETH HIRSCH (*New York City*): My contribution in tonight's symposium will be but to pay homage and tribute to the skill and dexterity and keenness of vision of my friend, Dr. Carman, and to pay a just compliment to Dr. Cole, who first described the peculiar deformity of the duodenum.

It is a pathognomonic sign. It is because of Dr. Cole's insistence that this deformity was characteristic of duodenal ulcer in the vast majority of cases and periduodenal disease in the remaining number of cases that the former triad of indirect signs so-called hyper-peristalsis, hypertonia and hypermotility have become comparatively unimportant. I must admit for a long time the morphological changes as bal-

anced against the motility changes and indirect signs were constantly discussed, but now the statistics bear out the truth of Dr. Cole's claims, and it is time that that be admitted. Thank you. (Applause).

DR. ARIAL WELLINGTON GEORGE (*Boston, Mass.*): I think I can say with Dr. Cole and Dr. Hirsch that it has been a great pleasure to hear Dr. Carman tonight, to see some of the errors he has made and appreciate that we are making the same sort of errors.

The percentages that he gives us are very reasonable and it pleases me more than ever tonight to know that some of our best internists in this country have heard Dr. Carman, and they must feel that in the hands of men such as Dr. Carman and Dr. Cole, roentgenology has reached a very accurate stage.

There is just one point that I would like to bring up. There are very few men in this country today who can do fluoroscopic work as Dr. Carman. If I had to read a paper such as Dr. Carman read tonight, I would say that the first source of error that would come to me would be the use of the fluoroscope versus plate method.

We are not concerned so much with the minute changes in the duodenum, we are more concerned whether there is a lesion of the duodenum. It is of no great concern whether it is a lesion of ulcer or adhesion of the gall-bladder. The man will have some suspicion that there is a lesion of the gall-bladder. I want to thank Dr. Carman for showing us these plates which he has tonight.

DR. CRANE: Dr. Sippy when he arose stated that no one knew as much about roentgen diagnosis of duodenal ulcer as Dr. Carman. We may say with equal accuracy that no one in the world knows more of the clinical symptomatology of ulcer than Dr. Sippy. (Applause). Any one who would take the pains to read the splendid contribution he has made in Oxford Medicine would be convinced of this. We may notice, however, in this article of Dr. Sippy's in Oxford Medicine he speaks of the diagnosis of gastric ulcer from the clinical symptomatology to include duodenal and gastric ulcer. It was not undertaken to distinguish whether the ulcer was in the duodenum or the stomach, from the symptomatology. That is as true today as it was in the time of Moynihan. The x-ray, therefore, is pre-eminent in its ability to distinguish between duodenal and gastric ulcer. We may say, in fact, that until the opaque meal was used, this differential diagnosis was almost if not quite impossible in the majority of cases.

The duodenal cap deformity which is so characteristic of the x-ray exam-

inations may be due to many possible conditions aside from ulcer, but they are not common. If we have a cap deformity without a symptomatology, we would have to have what is known as a latent ulcer.

Dr. Sippy in his recent contribution brings out sharply the fact that if we have latent ulcer we have ulcer without hyperacidity. At least I so understood it. I see he shakes his head. It is my belief, however, that without hyperacidity we do not get the epigastric pain in duodenal ulcer. I have had occasion lately to go over one thousand cases of gastric analysis made in our laboratory and I have been greatly impressed with the importance of a hyperacidity in the diagnosis of duodenal ulcer.

In no case of achylia have we been able to diagnose a duodenal ulcer. In the vast majority of cases the hyperacidity is present and I greatly deplore

the neglect into which the gastric analysis has gone.

I believe what Dr. Sippy says and what Dr. Hamburger has said may be taken to heart, that is that the roentgenologist can do well to consider carefully the clinical history of the case before he translates his roentgen findings into the terms of a clinical diagnosis.

DR. CARMAN: I think that the wisest thing for me to do is to thank these gentlemen and sit down. However, I might mention one or two things. When I first went to Rochester, nine years ago, I was very much interested in the history of the case to go along with our roentgen work. In other words, it was quite a comfort when we had made a diagnosis of duodenal ulcer to know that the patient had a fairly good clinical history. It was a good balance so long as we were making the correlation. If the clinician is going to make the correlation, it is a different proposition. If you can tell him what you

have and he makes the correlation, it does not do any harm. If you make the correlation, it works harm. We have clinical men who examine the patient, come to the x-ray department and want us to agree with their findings. We cannot do it. If we did we would find that we would lose our position in all probability. This applies more to gastro-intestinal work than to any other part of the human body. If we were going to make a diagnosis of a bone or chest condition, I would want to know something about the clinical side of the case. In gastro-intestinal work I feel it is not necessary.

About the groups that Dr. Smithies mentioned, I feel as does Dr. Sippy, that we see the same cases that Dr. Smithies sees and that Dr. Sippy sees. There was no special group considered in this series—just a year's work, and the cases were from the smallest type of ulcer up to the very large. I think that is all. I thank you. (Applause).

Practical Applications of Ionization Measurements of X-Rays*

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THE conclusions drawn from the following experiments are based on three assumptions, first, that the principle of the theory of homogeneous radiation as advanced by Dessauer in 1912, is correct; second, that the ionizing effect and the physiologic effect of x-rays are somewhere near the same; and, third, that the absorption and scattering rate of x-rays in water approximates roughly the rate in human tissue.

If we are willing to assume further that the action of x-rays on deep-seated lesions is the same as it must be on superficial lesions, that is, purely destructive, we can readily see that our problem in deep therapy is to deliver a sufficiently large dose to the deeper structures of the body without injuring the skin. If we are to use only two portals of entry, the front and back, for instance, it is obvious that we must use a technique giving a skin depth ratio of two to one, or one which will deliver at least fifty per cent of the skin dose to the center of the body. Taking the average distance from the skin to the center of the body as ten cm. we performed our experiments with a view toward determining the effect of various changes in the factors of

technique on the ratio between the surface and depth dose, making the readings at the surface of a water phantom and at a depth of ten cm. beneath the surface of the water. The results of our experiments showed, as we expected, and as has often been shown before, that increasing the voltage, size of fields, anode-surface distance and thickness of filter, lessened the surface depth ratio, or to express it differently, that increasing the four factors (voltage, size of fields, anode-surface distance, and thickness of filter) also increased the percentage of radiation delivered to the depth. They also showed that there seems to be a definite mathematical relation between these four factors, and that there is a limit to the economical increase of all of them except voltage.

It is obvious that increasing the anode-skin distance from twenty centimeters to forty centimeters, and the filter from a single thickness of sole leather to one-fourth millimeter of copper, for instance, will improve the surface depth ratio more than enough to compensate for the increase in the time required to administer a dose. It is equally apparent, that with our present apparatus, to increase the anode-skin distance to two hundred cm., and the filter to three millimeters of copper, would be absurd. There must be a limit somewhere. The object of this report is to call attention to the possi-

bility of establishing points beyond which increase in the size of fields, anode-skin distance and thickness of filters is no longer economical.

The first measuring apparatus which we constructed was crude, being made from an old cigarette box, a salvasan can, a length of gas tubing and a piece of lead pipe. A microscope with a scale on the objective was mounted opposite the windows in the tin can electro-scope in order that the rate of fall of the gold leaf might be observed and recorded by means of a stop-watch. The electro-scope was connected to the ionization chamber by an enameled copper wire mounted in sulphur at the ends and supported by cylinders of paraffin in the metal tubing. This electro-scope discharged ten small units in seven minutes, so that it was necessary to make a correction for the readings obtained.

Fig. 1 shows a photograph of a newer measuring apparatus in which the electro-scope is more completely enclosed by metal and the copper wire is supported by sulphur cylinders throughout. This instrument will normally discharge ten small units on the scale in about three hours and can be used without making a correction for the normal fall. The tank is of such size that it can be carried in a hand bag. The ionization chamber is mounted on half inch pipe tightly screwed together so that it can be

*—Read at the Meeting of the Chicago Roentgen Society, March 24, 1922.

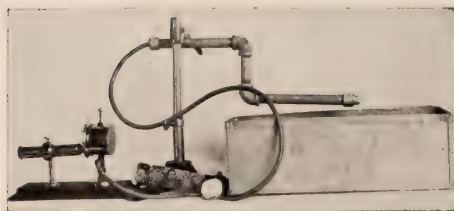


Figure I.—Photograph of Measuring Apparatus. requires 23 seconds to produce a fall of ten small units on the scale with the ionization chamber at the surface, and 57 seconds to produce the same effect with the ionization chamber at the depth of 10 cm., giving a ratio of 2.48, or a percentage of 40. If the voltage is increased to 220 kv. it only requires 9.6 seconds to produce the same discharge at the surface and 20 seconds at the depth, giving a ratio of about 2 and a percentage of about 50. In other words, by increasing the voltage from 140 to 220 we have not only succeeded in delivering 50 per cent of the total radiation to the depth instead

The following results obtained from measurements of the surface and depth doses with the technique used in my office two years ago, will illustrate the methods used in accumulating the data. The fixed factors were 140 kv. 5 ma., anode-surface distance 22.5 cm., surface depth distance 10 cm., and diameter of field 7.5 cm. The average number of seconds required to discharge ten small units on the scale with the ionization chamber at the surface of the water was 2.9, while the average number of seconds required to discharge ten small units on the scale with the ionization chamber at the depth of

VARIATIONS IN VOLTAGE

Ma., 3.5.		Filter Al., 1.0.		Cu., 0.5 mm.	
Anode to Surface, 50 cm.		Surface to Depth, 10 cm.		Full Field.	
Kilovolts	Seconds to Discharge at Surface	Seconds to Discharge at Depth	Ratio	Per Cent	
100	57.2	188	3.3	30.4	
120	37.1	101	2.8	36.7	
140	23.0	57.0	2.48	40.3	
160	17.7	41.6	2.37	42.5	
180	13.1	30.0	2.3	43.6	
200	9.8	21.7	2.2	45.1	
220	9.6	20.0	2.1	48	

10 cm. was 16.2. By dividing 2.9 into 16.2 we see that the ratio between the surface dose and the depth dose is as 5.6 is to 1, or by dividing 16.2 into 2.9 we can show that the percentage of the entire beam of x-rays delivered to a depth of 10 cm. is only 17.9.

In order to learn whether x-ray dosage can properly be expressed in terms of electrical measurements we made readings with different machines on different dates under conditions as nearly identical as it was possible to produce. Where it was possible to measure voltage by means of a sphere gap the results were nearly constant.

It will be seen from these data that not only does the time required to give the surface and depth dose diminish as the voltage is increased, but that the ratio between the surface and depth dose diminishes with each increase in voltage. For example, at 140 kv. it

of 40 per cent, but we have also reduced the necessary time of exposure from 230 units of time to 96 units.

Fig. 3 shows curves plotted to show the surface and depth doses at various voltages. It will be seen that not only does the time required to produce a given effect diminish with each increase in voltage, but that the lines also approach each other. It seems proper to conclude, therefore, that voltage should be increased to the limit of the capacity of the apparatus.

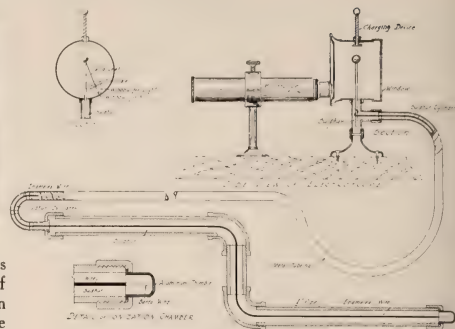


Figure II.—Diagram of Measuring Apparatus.

Before making a study of the effect of variation in the size of fields, we made a few measurements of comparative intensities at different parts of the field as defined by an ordinary tube-stand and found that there is not much difference at various points in such a field when the measurements are made in air. Other measurements made with the ionization chamber at the surface of water apparently showed that the intensity is much greater at the center of the field. When the ionization chamber was exposed through a small opening in a lead screen, the measurements in different parts of the field again became nearly equal, showing that the apparent greater intensity at the center of the field is due largely to secondary radiation in the water. We accordingly assumed that the intensity in all parts of the field as defined by the opening in the bottom of an ordinary tube-stand is sufficiently uniform that the whole beam may be used if desired.

It will be seen that the ratio is lessened with each increase in the size of the field and that the time required for the surface dose is also lessened with each increase in the size of the field.

Fig. 4 shows graphs of the surface dose, the per cent delivered to a depth of ten cm., and the ratio for variations in the size of the field. There is a very considerable drop, both in the surface dose and in the ratio with each increase in the size of the fields up to fifteen by fifteen cm., after which both curves flatten out. We may con-

VARIATIONS IN SIZE OF FIELDS

Kv., 140.		Filter Al., 1.0.		Cu., 0.25 mm.	
Anode to Surface, 40 cm.		Anode to Depth, 50 cm.			
Size of Fields in cm.	Seconds to Discharge at Surface	Seconds to Discharge at Depth	Ratio	Per Cent	
2.5x2.5	12.3	59.5	4.84	20.7	
5x5	11.5	45.0	3.91	25.5	
10x10	10.2	33.6	3.3	30.3	
15x15	9.7	31.2	3.21	31.0	
20x20	9.6	30.0	3.1	32.0	

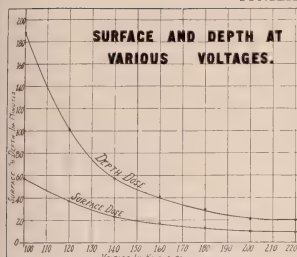


Figure III.—Graphs of the discharge in seconds at the surface of water and depth of 10 cm. with various voltages.

VARIATIONS IN DISTANCE AND SIZE OF FIELDS

Kv. 140, Ma. 3, Full Field, Filter Al. 1.0, Cu. 0.5, Surface Depth, 10 cm.

Anode Surface Distance in cm.	Seconds to Discharge at Surface	Seconds to Discharge at Depth	Ratio	Per Cent
20	5.5	20.9	3.61	25.3
30	11.2	31.9	2.84	35.1
40	19.4	47.1	2.43	41.2
50	28.0	56.9	2.03	49.2
60	35.7	68.0	1.9	52.5
70	46.7	82.0	1.76	56.3
80	56.7	99.6	1.75	56.9

clude from the data and graphs that the size of fields should be at least fifteen cm. square.

The following data is for variations in distance and size of fields combined, that is, the full field was used and naturally increased in size as the anode surface distance was increased.

With each increase in anode-surface distance the ratio is lessened, but the time required to give the surface dose is increased. The question that arises, then, is at what point does economical increase in anode-surface distance end?

Fig. 5 shows graphs of the surface dose, surface depth ratio, and per cent delivered to the depth, for variations in distance and size of field. Examination of the graph of the surface dose shows that it is a straight line, which is what we would expect. A break occurs in the graphs of the surface depth ratio and per cent somewhere between forty and fifty cm. A search for an explanation of this break showed that at a distance of about forty cm. the field became so large that it extended beyond the walls of the tank, and after this the lessening effect on the surface depth ratio of the increasing size of field was no longer obtained.

When x-rays are administered through small fields, the center of each field is the base of a pyramid of tissue which receives a progressively smaller percentage of the skin dose as depth increases. The corner of a field where it joins the three adjacent fields is the apex of a pyramid which a short distance under the skin receives almost four times the skin dose. If instead of treating four small fields the tube be

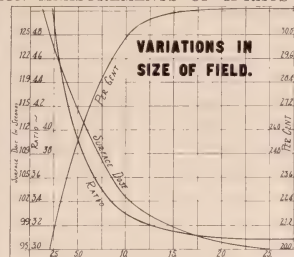


Figure IV.—Graphs of the discharge in seconds at the surface of water, the surface-depth ratio, and the per cent at a depth of 10 cm., with various sizes of field.

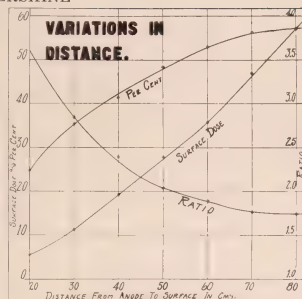


Figure V.—Graphs of the discharge in seconds at the surface of water, the surface-depth ratio, and the per cent at a depth of 10 cm., with variation in distance and size of fields.

removed to twice the distance and a single field, covering the same area as the four small fields, be given one treatment four times as long as a single small area, it is evident that the skin dose will be the same. The total amount of radiation received by the body will also be the same. It will, however, be more evenly distributed

VARIATIONS IN FILTER

Ma., 5. Diameter of Field, 10 cm.

Anode Surface Distance, 50 cm.

Anode Depth Distance, 60 cm.

Kilovolts (Maximum)	Filter in mm. Copper	Seconds to Discharge at Surface	Seconds to Discharge at Depth	Ratio	Per Cent
75	None	15.9	225	14.15	7
75	.065	37.8	304	8.04	12.46
75	.103	52.2	355	6.8	15
75	.134	66.4	404	6.09	16.4
75	.268	135.6	609	4.2	22.26
75	.536	335.6	960	2.86	35
75	.768	603.2	1583	2.45	38.02
102	None	7.6	54.2	7.14	14
102	.065	14.0	66.0	4.7	21.2
102	.103	17.5	73.4	4.19	23.8
102	.134	19.9	76.0	3.82	26.2
102	.268	32.9	104.0	3.16	31.6
102	.536	66.0	164.4	2.71	36.9
102	.768	96.2	233.2	2.42	41.2
133	None	5.4	33.3	6.16	16.21
133	.065	9.3	40.2	4.32	23.13
133	.103	11.5	42.0	3.63	27.5
133	.134	11.8	44.4	3.56	28.1
133	.263	17.9	54.4	3.0	34.7
133	.536	30.2	75.8	2.51	40.0
133	.768	43.1	96.8	2.24	44.6
170	None	4.05	20.1	4.96	20.14
170	.065	6.46	22.3	3.44	29.05
170	.103	7.9	26.8	3.89	29.47
170	.134	9.05	28.5	3.16	30.79
170	.268	12.0	32.7	2.72	36.69
170	.536	18.0	42.3	2.35	43.73
170	.768	21.9	47.7	2.17	45.91
210	None	2.77	11.55	4.16	24.0
210	.065	4.36	13.8	3.17	31.5
210	.103	5.0	14.8	2.96	33.7
210	.134	5.93	16.1	2.71	26.8
210	.268	7.65	18.75	2.45	40.8
210	.536	9.85	22.9	2.33	43.0
210	.768	12.0	24.4	2.0	49.0

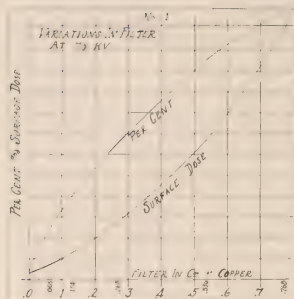
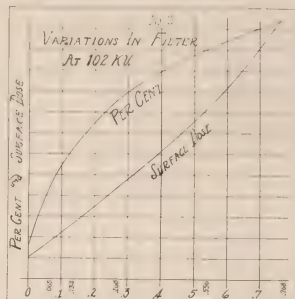


Figure 6.—Graphs of the per cent of the entire radiation delivered to

and there will be a substantial drop in the surface depth ratio due to the lessened divergence of the rays at the greater distance. If the tube be removed to three times the distance it will be necessary to make an exposure nine times as long in order to get the same effect on the skin. In this case, however, the part of the beam falling outside of the body will be wasted and the increase in distance will be no longer economical. We may conclude, therefore, that the anode-surface distance should be just great enough to permit the entire surface to be treated at one time, which, with the usual type of tube stand, and the average sized patient, will be somewhere between fifty and sixty cm.

The following data were obtained by using increasing thickness of copper filter with various voltages. Because of the difficulty of obtaining anything but very small pieces of uniformly thin copper, these readings were made in a field only ten centimeters in diameter, and the percentages are somewhat less than they would have been had a full field been used.

In Fig. 6 the per cent of the total amount of x-rays reaching a depth of ten cm. in water, with increasing thicknesses of filter, and five different voltages, is plotted against the time required for the discharge at the surface on an arbitrary scale. Especially with the lower voltages, the rise is consider-



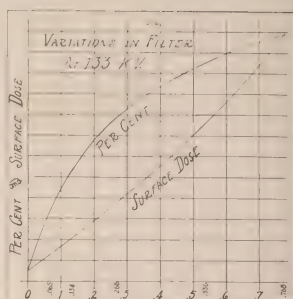
a depth of 10 cm. in water, and the time required for discharge at the

surface, corresponding to the introduction of the first few layers of filter. With each increase in voltage, the region in which the per cent curve tends to become parallel to the surface dose curve, corresponds to a greater thickness of filter.

Fig. 7 shows the graphs of the surface depth ratios produced by variable thicknesses of filters at voltages of 75, 102, 133, 170 and 210 kv., all plotted on the same scale to show the flattening of the curve with each increase in voltage. The thickness of filter required to produce a given ratio diminishes as voltage is increased. For instance, a ratio of four to one can be obtained with 75 kv. by using 0.3 mm. copper; with 102 kv. by using .125 mm. copper; with 133 kv. by using 0.1 mm. copper; with 170 kv. by using .05 mm. copper; while with 210 kv. it is only necessary to use about .01 mm. copper.

Fig. 7 also shows that with a given thickness of filter, the ratio becomes less with each increase in voltage. For example, with a filter of .134 of copper, the ratio with 75 kv. is 6; with 102 kv., 3.8; with 133 kv., 3.4; with 170 kv., 3, and with 210 kv., 2.7. While Fig. 7 shows that fairly low ratios may be obtained even with low voltages, by increasing the thickness of the filter, it does not show the tremendous increase in the time required for the surface dose. By referring to the data we see that with low voltages and thick filters it is necessary to extend the time of exposure beyond the limits of economy, or, in other words, it is necessary to remove too great a proportion of the beam of rays.

Fig. 8 shows the relative length of time required for the surface dose with the five voltages and various thicknesses of filters. The height represents time, and the width represents thickness of copper. This illustration shows that the introduction of filters lengthens the time required for the sur-



surface, with variations in filter thickness and various voltages.

face dose much more, proportionately, with the lower than the higher voltages. It also shows the proportion of all x-rays removed by the different thicknesses of filter. For example, with 133 kv. it requires 5.4 seconds to give a surface dose when no filter is used. When sufficient filter has been introduced to require twice this time, or 10.8 seconds for the surface dose, it is evident that half the beam has been absorbed. The amount of copper necessary to absorb half the beam produced by 133 kv., is, therefore, seen to be about .125 mm. When sufficient filter is introduced to necessitate four times as long an exposure as the unfiltered dose, it is evident that three-fourths of the total beam has been absorbed. With 133 kv., three-fourths of the beam is absorbed by a little less than four-tenths mm. of copper. In the same way the three-fourths absorption values are shown for the other voltages. By referring to the data we find that the limit of economical increase in thickness of filter follows fairly closely the three-fourths absorption value. We may conclude, therefore, that with 133 to 140 kv., which is approximately the voltage that most of us are using at this time, the limit of economical thickness of filter is approximately 0.4 mm. of copper, and that with 200 to 220 kv. the limit is somewhere near .75 mm. of copper.

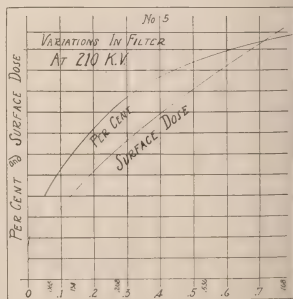


Figure 6.—Graphs of the per cent of the entire radiation delivered to

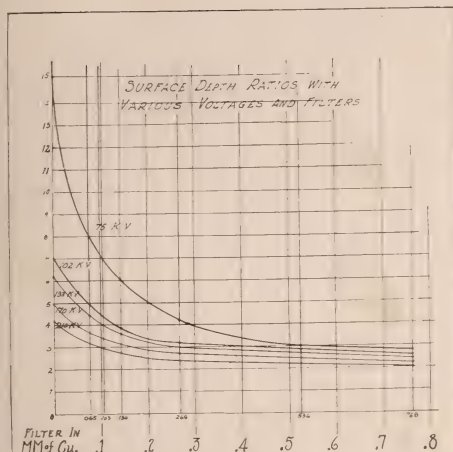


Figure VII.—Curves showing surface-depth ratios obtained with various voltages and filters.

SUMMARY

1. Increasing voltage lowers the surface depth ratio and lessens the time required for the administration of a given dose. The limit of desirable increase in voltage is the capacity of the apparatus.

2. The intensity of the whole field as defined by an ordinary tube-stand, is so nearly uniform that the entire beam may be used.

3. The size of the field should be at least fifteen cm. square.

4. The anode-skin distance should be just great enough to allow the entire surface to be treated at one time. With average sized patients the limit of economical increase in anode-skin distance is between fifty and sixty cm.

4. The limit of economical increase in filter thickness depends upon the voltage employed, and corresponds

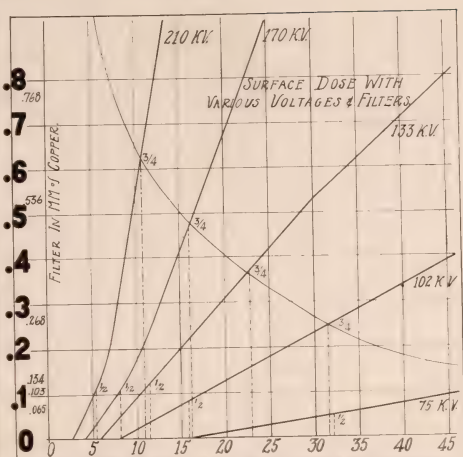


Figure VIII.—Graphs of the time required for discharge at the surface with various voltages and filters. The relatively small half-absorption values with 210 and 170 kv. are due to technical errors. The lines should be nearly straight.

fairly closely to the thickness which will remove not much more than three-fourths of the entire beam of x-rays. With voltages between 130 and 140 kv., the limit is about 0.4 mm. of copper; and with 200 to 220 kv., the limit is about .75 mm. of copper.

My thanks are due to Dr. L. D. Weld of Coe College for many helpful suggestions, and to Mr. Scott Smith for his assistance in making the reading and plotting the curves.

Treatment of Malignant Neoplasms of the Tonsils*

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A review of the literature on new growths of the tonsil emphasizes several surprising features. Malignant tumors in this location are considered rare, and, with a few exceptions, reports are of individual cases. The question of diagnosis is uncertain in many reports. The opinion seems to prevail that carcinoma occupies a minor place in the entire group while a loose classification of sarcoma covers the majority of cases. In spite of its accessibility and early symptomatology the older methods of treatment have accomplished probably less here than in any of the intra-oral group of neoplasms.

In view of this it seems advisable to report on the results obtained to

date with radium at the Memorial Hospital.

Because of the difficulty in deglutition, neoplasms of the tonsil are usually noted early, but, unfortunately, they rarely receive proper attention at this stage. Valuable time is usually lost in using local caustic applications followed by anti-syphilitic treatment and when these fail it is a common thing to find an incomplete tonsillectomy performed. The liberties taken with tonsillar ulcers seem out of proportion even to those taken with other intra-oral new growths. It frequently happens that a correct diagnosis is not made until the disease recurs locally or appears in the cervical nodes. The factor of error seems greatest in carcinoma of the tonsil. This is probably due to the fact that the ulcer is small and slow growing and that palpation, as a means

of clinical examination, is seldom resorted to. This type of growth, however, predominates in older subjects, especially after the fourth decade. In young patients, lymphosarcoma is the most common neoplasm encountered. It assumes various atypical forms and hence we find in the literature many varieties of sarcoma reported in the tonsil. In fact, all of these probably belong to the group of lymphosarcomas or malignant granulomas.

The report and extensive resume made on this subject a few years ago by Matthews⁽¹⁾ is most instructive. He considers practically all cases surgically inoperable and points out that, even in cases apparently localized, the prompt recurrence following surgical removal indicates that infiltration at the base is more widespread than is apparent. This is especially true of lymphosarcoma.

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

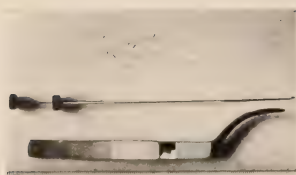


Figure I.—Unfiltered tubes of radium emanation used for insertion interstitially.

Matthews concluded that, with the methods in practice at the time of his report, the cure of malignant disease of the tonsil was effected in only a small percentage of cases and that the operative procedures which promised most chance of cure were so extensive as to be attended with considerable mortality. This referred especially to lateral or external pharyngotomy. Of the more limited procedures he felt that tonsillectomy was of little value but that tonsillectomy plus cauterization gave a much better chance. With tonsillectomy alone, in twenty cases of sarcoma and three of carcinoma, most presumably early and favorable cases, not one was reported to have lived two years without recurrence, and only three (all sarcomas) were reported without recurrence at periods between six months and one year. He felt that in children, especially, radical treatment was of little avail and usually detrimental. Of cases treated by tonsillectomy and cautery he found fifteen reported cases with one free from recurrence after three years. In this group, Jacobson's ⁽²⁾ case is the longest reported without recurrence—eleven years. Of Matthews' own twenty-two cases, only a few of which came to operation, there were no cures. In his group of collected cases there were eighty-four of sarcoma. Of these eleven remained without recurrence six months to one year, five one to two years, six two to three years and one over three years. The case going over three years was the one treated by combined tonsillectomy and cautery. Of those between two and three years one was the result of combined tonsillectomy and cautery, four, lateral pharyngotomy, and one Coley's toxin without operation. In the collected group of twenty-three carcinomas he found one case without recurrence six months to one year, three cases one to two years and three over three years. Two of the cases over three years were by combined tonsillectomy and cautery. Coley's report in 1915 gave four cases, probably all lymphosarcoma, which remained well for periods of one to

eight and one-half years following the use of his toxin alone.

Of the other operative procedures practically no good results were reported. The method of exposure by cheek splitting gave no case over two years without recurrence. This method was probably not resorted to, however, except in very advanced cases. Dabarn's method of ligating both external carotids and injecting paraffin into the vessel on the affected side gave no results worth mentioning. In Jacobson's report, the cures by open mouth methods are placed at ten per cent. This rate is, however, questionable because the time interval was short and the group of cases small. Matthews noted the palliative relief afforded by x-ray in some cases. Decrease in pain and retardation of growth were the benefits observed from this agent.

Various other observers have noted the palliative effects of x-ray, but all reports are of one or very few cases and no reported complete regression is of sufficient duration to make it of statistical value.

A few isolated reports are also to be found on the use of radium, either alone or in conjunction with x-ray. In these the time interval is short, and the final results inconclusive, except in so far as they relate to palliative relief. In a number of them the radium dosage was hopelessly small. A very recent report of a case by Perrier ⁽³⁾ is most interesting. He reports an extensive lymphosarcoma, treated by the Janeway ⁽⁴⁾ method of burying radium emanation in tubes, both in the tonsil and cervical nodes, and clinically free from disease at the time of his report—two months after the close of treatment.

This method of treating new growths of the tonsil with radium emanation buried interstitially was first introduced in our work over five years ago by the late Doctor H. H. Janeway and has proven of inestimable value.

It has been our experience that, in comparison with other intra-oral neoplasms, those of the tonsil are particularly susceptible to radium. This may be due to the fact that in young subjects the active lymphoid tissue exerts a strong defensive force, while in later

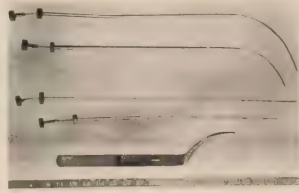


Figure II.—Trocar needles used for insertion of radium emanation tubes.



Figure III.—Two mm. brass tray to hold tubes for external application over the neck.

life the lack of blood supply and resultant tonsillar atrophy favors the action of radium. Once the disease has extended beyond the tonsil, however, the problem becomes more complex. The same cancer tissue seems to be influenced in its degree of malignancy by the nature of the soil in which it grows; the abundance of blood supply, freedom of movement and arrangement of anatomical planes seem to be the controlling factors in this apparent variation of growth.

As the disease advances in the tonsil one very common extension is that across the base of the anterior tonsillar pillar to the tongue. In this location it is quite as difficult to deal with as a primary carcinoma of the tongue. We feel that, in cases where this involvement is present when the patient is admitted to the service, the prognosis is only about fifty per cent as good as it would be were the disease confined entirely to the tonsil. Extension to the other adjacent structures—anterior tonsillar pillar, soft palate or lateral pharyngeal wall—is equally as complicating except in so far as the relative accessibility is concerned. In the tongue infiltration is deeper and more ill-defined. This is due to greater thickness of tissue, a rich blood supply and the free motion of that organ.

As for regional extension of the disease to cervical lymph nodes, we feel that this process is embolic, at least in so far as carcinoma is concerned. In view of this we have for the past few years divided the treatment of all intra-oral carcinoma into two stages—first, treatment of the primary growth, and second, treatment of the cervical nodes. In this report the same plan will be followed with exceptions made for lesions other than carcinoma.

I.—TREATMENT OF THE PRIMARY GROWTH

We feel very strongly that all malignant neoplasms primary in the tonsil, unless very far advanced, should be treated by radium entirely. Furthermore, a clinical classification at the beginning of treatment should be made, based on the ultimate result to be hoped for. In other words, a distinction should be made between the case with possi-

bilities for complete regression of the disease and the other for which palliation only can be expected. Treatment should be given accordingly.

Some of the very far advanced cases should resort to medicinal measures rather than the physical agents for temporary relief.

Thorough and efficient radiation of a new growth of the tonsil designed to cause a complete regression of disease necessitates putting the patient through a painful period. Unless this complete regression can be reasonably expected, such a procedure is unwarranted. Hence the need for classification before beginning treatment. While the tonsil is readily exposed to vision, it is not so readily accessible to the older methods of radium application. Previous to 1916, when we were using only surface radiation we could do no more than give palliative relief. It is impractical to make an accurate and satisfactory surface application of radium to the tonsil for a period long enough to afford proper dosage. Even with radium tubes held in place by a hook at one end we were unable to maintain the accuracy and intimacy of application necessary for uniform results. However, as soon as we began the use of radium emanation buried interstitially our results at once improved. This method has been described several times before and needs only brief reference. Fine glass capillary tubes 0.3x3 mm. in size, containing radium emanation, are inserted at any desired depth

in the neoplasm by means of trocar needles. Since this emanation decreases in value at the rate of approximately fifteen per cent per day, the total dosage to be derived from a given amount embedded can readily be calculated. The thin wall of the glass tube removes but little more than the alpha rays so that the total intensity of both beta and gamma rays is directed at the new growth. Apart from the ease of application there are several advantages in this method. Utilization of the beta radiation produces a very intense local effect. The tubes are held in place by the tissues and afford an excellent cross-fire of radiation. Radiation is evenly distributed, since the tubes can be buried at any desired depth; this is especially important in reaching the actively infiltrating base of a new growth. The slow prolonged radiation permits of greater dosage and is of further significance if malignant cells are more susceptible at the time of division.

The same method can be approximated by using thin metal needles containing radium salt buried interstitially. The chief disadvantages are the lesser amount of beta radiation obtained, the shorter exposure, smaller dose necessitated and the difficulty of retaining them in position.

We have never had trouble from the glass capillary tubes as foreign bodies. In solid tumors they become encysted by fibrous tissue excited to formation by the intense radium inflam-

mation, while in more friable ulcerating lesions such as are usually found in the tonsil the majority of them probably slough out.

We have, however, had trouble from the amount of radium used per tube. In our earlier work with buried emanation we used tubes of three, four and even five millicuries each. These produced an unwarranted amount of sloughing with frequent resultant hemorrhages, to say nothing of the unnecessary suffering on the part of the patient. We now feel that tubes of one mc. each or thereabouts give best results. They occasion less sloughing and pain, and hemorrhage, which is still a factor to be watched for carefully in tonsillar work, is much less frequently encountered. Tubes of much less than one mc. do not afford enough gamma radiation to be efficient, unless a larger number are used. This traumatizes the tissues too much. In carcinoma, one millicurie of radium emanation per cubic centimeter of tumor tissue is approximately the required dosage. With lymphosarcoma or malignant granulomas, on the other hand, about one-half this amount is all that is usually required. It is always best to aim at complete regression from a single dose. It entails less suffering on the part of the patient, and, furthermore, a subsequent dose can never be as accurately placed because of the surrounding inflammatory tissue. The amount of fibrosis following the first massive dose renders a second dose less

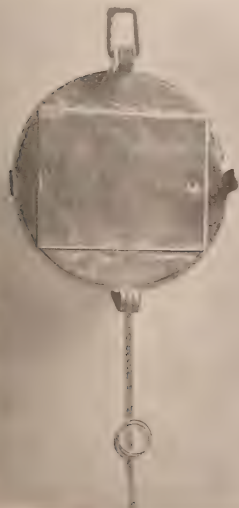


Figure IV.—Three cm. block to afford uniform separation of brass tray from skin.



Figure V.—Brass tray clamped in place on block.

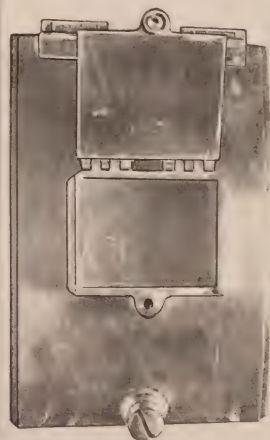


Figure VI.—Radium pack; two mm. brass filtration; for application at varying distances over cervical nodes.



Figure VII.—Typical carcinoma of tonsil.

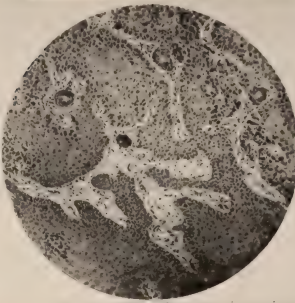


Figure VIII.—Typical squamous carcinoma of tonsil.

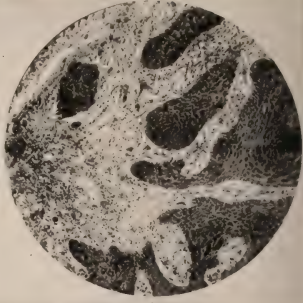


Figure IX.—Papillary acanthoma of tonsil.

effective and is more apt to be followed by hemorrhage from a rapid breaking down of this fibrous tissue. Wherever subsequent treatment is necessitated following an initial massive dose, the patient should be kept under close observation until all slough has separated or the external carotid artery should be ligated as a precaution.

Where treatment is to be given for palliative purposes only, much smaller amounts should be used and these can be supplemented from time to time without at any period exciting an extremely painful reaction. In treating these advanced cases care should always be taken to prevent making them worse rather than becoming too optimistic over faint possibilities of controlling the disease entirely and pushing treatment too radically.

In introducing the emanation tubes with trocar needles, care should be taken to make the distribution as accurate as possible with the greater concentration of dosage toward the base of the neoplasm rather than near its surface. Two points are of special importance in locating the tubes. One of these is at the base of the anterior tonsillar pillar to block off extension to the tongue. The other is the lowermost part of the lesion, which is frequently just out of sight unless the indirect method is used. Failure to place the emanation properly at this point may permit extension of the disease to the lateral pharyngeal wall or the extreme base of the tongue before it is recognized. In order to introduce the tubes more accurately here we use curved trocar needles and introduce them by the indirect method.

In the cases of recurrent new growths of the tonsil, which, unfortunately, we see only too frequently, the problem is very much altered and recurrence or implantation is usually at the periphery. In these cases the emanation tubes must be placed very widely.

The question of trauma must always be considered in using emanation tubes interstitially. Wherever possible a surface application of filtered radium should be used a few days before introducing the tubes. In the tonsil, this can be done very efficiently by placing heavily filtered radium over the tonsillar area, externally. Our own plan is to use two thousand to twenty-two hundred millicurie hours filtered by two mm. of brass and placed three mm. from the skin surface just posterior to the angle of the mandible. We feel that this renders emboli due to trauma much less harmful, thereby relieving in large measure the danger of introducing the trocar needle.

II.—TREATMENT OF THE CERVICAL NODES

Since this phase of the work has been recently dealt with ⁽¹⁵⁾ in considering the treatment of the neck in all cases of intra-oral carcinoma, only brief mention of it will be made here.

Because of our belief in the embolic theory of extension of carcinoma to the cervical nodes, we have adopted an expectant plan of treatment, or rather, a combination of radiation and conservative surgery.

As soon as a case enters the service x-ray is applied to both sides of the neck and a heavily filtered tray of radium is placed over the tonsillar region, externally. If a definitely enlarged node is present in the neck the radium ray is used over this also. If the neck is free from palpable involvement, x-ray is repeated at intervals over a period of several weeks. If surgically operable nodes are present at first, or appear subsequently, a complete unilateral block-dissection is done under local anaesthesia, two to six weeks following the external radiation, and radium emanation is buried at all suspicious points in the wound, especially where the lymphatic channels are severed. If the nodes be extensively in-

volved in the beginning or are found at the time of operation to have invaded their capsule, no attempt is made to remove them, but emanation tubes are buried uniformly throughout the mass. We feel that it is best to expose such nodes surgically before burying the emanation because of the altered anatomy and because the tubes can be more accurately placed.

While external radiation produces marked inhibitory changes we have never seen complete destruction of epidermoid carcinoma metastatic in the cervical nodes from its use alone. On the other hand, we now have a small group of cases showing complete regression following the burying of emanation throughout the nodes in the manner just described.

In all cases where the neck structures are exposed surgically the external carotid artery on the side of the primary lesion should be ligated to prevent hemorrhage unless the primary site is entirely healed.

In dealing with the cervical extensions of lymphosarcoma or the malignant granulomas the physical agents alone should be used. Preferably this should be by a combination of x-ray over the surface and radium emanation interstitially. It should be stated most emphatically that surgery plays no part in the treatment of this group.

STATISTICS OF TREATED CASES

During the past five years we have treated one hundred and forty-nine cases of malignant neoplasms of the tonsil.

Many of these were very advanced cases, frequently recurrent after operation, and as we review the work three errors must be recognized, especially in the early part of the series. A large group of cases were so advanced that I am convinced they would have been better off had no radium been used. There comes a time in the course of the disease when medical measures give

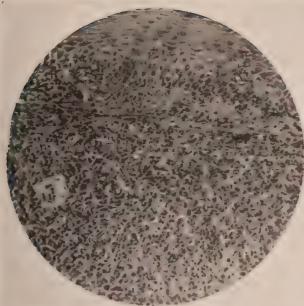


Figure X.—Lymphosarcoma of tonsil.

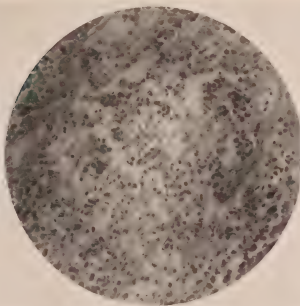


Figure XI.—Very cellular lymphosarcoma of tonsil.

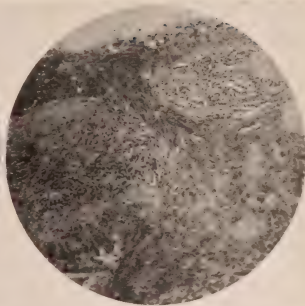


Figure XII.—Cellular carcinoma in lymph-node, untreated.

more relief than the physical agents. Some cases which should have been classified for palliative treatment only were treated too vigorously in the hope of obtaining a complete regression of disease. In these, the treatment defeated its own purpose. In our earlier work with buried emanation tubes used were for the most part too strong so that an unnecessary amount of suffering was produced to obtain a result which can now be attained with more comfort and less danger.

Our present follow up of these cases shows the following results. Of one hundred and twenty-four cases of carcinoma of the tonsil, twenty-eight cases are now clinically free from disease. Two other cases were free from clinical evidence of disease for fifteen months, at which time they were lost track of. Twenty cases at present under treatment are progressing favorably and a fair number at least bear promise of a complete clinical regression.

Forty-one cases were definitely improved for varying periods of time, but finally either died of the disease or are steadily becoming worse. Improvement in these cases means slowing up or definite regression of the growth, relief from pain, reduction in size of cervical nodes or prevention of their breaking down and fungating externally. Twenty-seven cases were absolutely unimproved by treatment and ten more were completely lost track of, so that they must be classified with those totally unimproved. Of the carcinomas, ten were recurrent cases, two of which were with recurrent cervical nodes and an unrecognized primary lesion in the tonsil.

Twenty-four cases belonged to the group of lymphosarcomas or malignant granulomas. It is my impression that a few more cases belonging in this group are filed under the general heading of lymphosarcoma and hence were inaccessible for this report. Of this group

six cases are now free from clinical evidence of disease. One shows an excellent palliative result of over three years duration, but at no time has he been entirely free from clinical evidence of disease. Six of these cases were recurrent.

One case of rhinoscleroma of the tonsil is of interest. The patient has been under treatment for over three years, at times showing an apparent complete regression, only to reappear in some adjacent area of mucosa.

Of the twenty-eight cases of carcinoma of the tonsil reported clinically free from disease at present, the average duration since the initial treatment is twenty-six months. The longest period is fifty-six months and the most recent four months. In ten cases, neck operations, as previously described, were performed and in these the average duration is twenty-eight months. The oldest is fifty-six months and the most recent six months.

Another case, of interest from a palliative standpoint, was admitted eighteen months ago with an advanced primary growth and metastases in both

sides of the neck. This patient has been treated by burying emanation, entirely, and while he has not a complete regression, there is nevertheless complete temporary control and no subjective symptoms. This case is cited simply as an example of palliative relief.

Of the lymphosarcomas or closely allied lesions one case has had a complete regression for over four years, another sixteen months, one twelve months, one eight months and two six months. Another case was lost track of a year and a half after treatment with complete regression at that time. One of the most interesting cases in this group is a patient in whom the tonsillar lesion cleared up promptly, but a large mass appeared in the neck and another in the lower left quadrant of the abdomen. Under heavy radiation these reduced somewhat and have remained stationary and quiescent without treatment for two years. His initial treatment was over three years ago.

In general, lymphosarcoma, because of its extremely cellular structure, responds very promptly to radium and

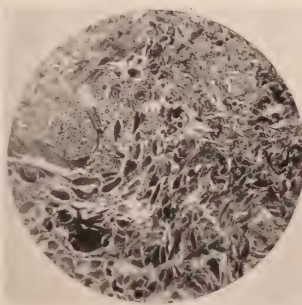


Figure XIII.—Lymph node invaded by carcinoma metastatic from tonsil, treated by heavy x-ray radiation and removed surgically one month later.

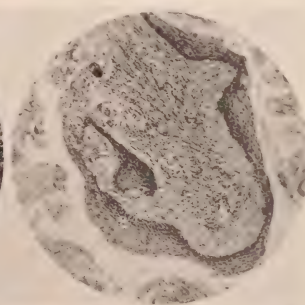


Figure XIV.—Lymph node invaded by carcinoma, treated by implantation of radium emanation bare tubes and removed surgically three weeks later.

the area treated tends for the most part to remain well, but dissemination is early and widespread and it is doubtful if many permanent results can be hoped for from radiation of the local process.

CONCLUSIONS

1. In all malignant neoplasms of the tonsil, radium is the agent of choice for treatment of the primary growth.

2. Best results can only be obtained in these cases by interstitial radiation—either by means of radium emanation or lightly filtered needles containing radium element embedded in the growth. This should be supplemented by heavily filtered external radiation—either x-rays or radium.

3. The treatment of cervical metastases of carcinoma of the tonsil is best managed by a combination of radium, x-ray and conservative surgery.

4. In lymphosarcoma or the malignant granulomas of the tonsil, surgery plays no part whatever. Metastases to the cervical nodes or elsewhere should be managed entirely by a combination of radium and x-rays.

Our experience with this group of cases encourages us to continue the plan of treatment along these lines.

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Figure XV.—Lymph node invaded by carcinoma, treated by imbedding of bare tubes of radium emanation, and removed surgically two months later. Note the complete replacement of carcinoma by fibrous tissue.

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Fractures of the Carpal Scaphoid

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MECHANISM AND TYPES OF FRACTURES

John B. Murphy classifies the scaphoid fractures into three types:

(1) Simple transverse fracture produced by a force applied to the distal portion of the hand in the direction of the long axis of the radius, the same cause which at other times produces a Colles' fracture. It usually occurs in falls on the outstretched hand with the latter in the abducted position. The force is transmitted from the distal and palmar portion of the hand to the radius through the middle or thinnest portion of the scaphoid while the bone as a whole is tightly gripped and allowed no movement, so it naturally gives way producing a "snapped waist" fracture.

Speese⁽²⁾ considers some of these fractures to be the result of compression of the weakest or middle portion of the scaphoid when forcibly jammed between the two stronger bones, as proximally it is applied against the radial styloid and distally it receives the os magnum as a wedge in its concavity.

The fracture usually occurs in the neck or waist of the bone. About sixty-six per cent of all scaphoid fractures are claimed by Alan H. Todd⁽⁵⁾ to be of this type.

(2) Transverse fracture with impaction of fragments. This type of fracture results from backfiring of a motor while cranking. The wrist is in normal extension and in ulnar deflection when the violence is applied. The fragments become impacted and, with no interference, undergo gradual absorption.

(3) Fracture of the tuberosity. This type also results from backfiring, the wrist being in a state of forcible extension and in ulnar deflection. In this case the external radioscaphoid ligament undergoes sudden severe tension and tears off the tuberosity. This is the only extracapsular fracture of the carpal scaphoid.

A very rare simple transverse fracture of this bone occurring in forcible hyperflexion of the wrist has been described by Vialle⁽³⁾ and Vallas. According to these investigators the usual tendency of the carpal bones to form two rows may be responsible for this forcible breaking of the scaphoid into separate distal and proximal fragments. It is probable that this fracture occurs in those rare instances where the scaphoid has two osseous centers and is

but weakly united with calcified cartilage. (vide infra, Bipartite Scaph.)

Cases of scaphoid fractures are frequently complicated or complicate other fractures. In the great majority these occur in connection with fractures of the lower end of the radius. Dr. A. F. Tyler⁽⁸⁾ advocates that every Colles' fracture should be examined for a scaphoid fracture as well. The Vialle, also known as Barton fracture, is a breaking off of the posterior lip of the lower end of the radius, produced by the impaction of the proximal portion of the scaphoid against its dorsal articular surface. At times the scaphoid itself escapes injury. In other instances fracture of the base of the metacarpal of the thumb or even of the second metacarpal bone occurred.

COURSE

A common observation in scaphoid fractures is that they tend to remain ununited. There is no tendency for the opposed surfaces of the fragments to cover up with cartilage or fibrous tissue, but they remain rough. Often a slight exuberance appears which causes severe pain when rubbing against the articular surface of the radius. Due to the fact that the scaphoid is comparatively free from attachments and that the majority of the fractures are intracapsular there is but very little displacement, so that displacement cannot be considered as a cause of non-union. John B. Murphy attributes this failure of union to a damaged blood supply, which even in the unbroken bone is not rich. Codman and Chase⁽⁴⁾ believe that union is hindered by the fact that the fragments are constantly bathed in synovia. "It is in the very nature of the synovial fluid to exert an inhibitory action on plastic processes," observes Todd. The constant irritation sets up in addition a chronic inflammatory condition which even increases the quantity as well as the viscosity of the fluid.

John B. Murphy observed that fractures of type three, fracture of the tuberosity, alone of all the others, tends to unite if proper fixation is applied. It is explained by the fact that the fragments are outside the capsule.

Preiser⁽¹³⁾ observed a rarifying osteitis beginning in the fragments after a certain interval. Tissue sections revealed a tendency to cystic degeneration. Often a pseudoarthrosis develops which gives way on the least turn or twist.

FRACTURES of the carpal scaphoid were recognized only after wider use of the x-rays in injuries of the wrist. In pre-x-ray times diagnoses of "sprains" covered all carpal injuries, but thanks to the better study of these injuries with the aid of x-ray, fractures of the carpal scaphoid are at present recognized to constitute a clinical entity with characteristic symptomatology and physical findings.

INCIDENCE

Up to about 1900 there was practically no literature on the subject. About 1910 various investigators reported the incidence of the carpal scaphoid fractures to be five-tenths per cent of all fractures, but in 1915 John B. Murphy⁽¹⁾ found this estimate too low and placed it at one to two per cent. He also found one fracture of the scaphoid to every ten, or fewer, of Colles' fractures. There is no doubt but that better diagnosis and a wider use of motor cars, the cranking of which has been an important causative agent of these fractures, are responsible for their increased frequency.

Fractures of the scaphoid are mainly incident to active and forceful manual work. Therefore, with the exception of cases produced by accidental falls, they are almost entirely limited to the male sex, to the age of greatest activity, that is, between eighteen and forty, to people actively engaged in manual work, and chiefly to the right hand.

CAUSES

The several fractures of the carpal scaphoid result from the application to the bone of, first, indirect violence, such as is produced by falls and backfiring of a motor while cranking, and, second, direct violence. The latter need not be discussed. Our discussion will, therefore, be limited to the former. A glance at the wrist of a skeleton will find the scaphoid occupying a buffer position between the lower end of the radius and the os magnum. Further examination will reveal that the scaphoid is very tightly enclosed between the two stronger bones when the hand is abducted, that is, when deflected radially, while in adduction, that is, in the ulnar deflection position it is placed more radially to the outside of the carpus. Therefore, a force transmitted along the os magnum, scaphoid, and radius, particularly when the hand is in abduction, is likely to break the weakest one of the three, that is, the scaphoid.

SYMPTOMS AND PHYSICAL SIGNS

Cases of fracture of the carpal scaphoid present themselves either recently after the injury, or, more frequently, from several months to one to two years after the initial injury, with the usual complaint that the wrist is not as good as it was, or that it hurts, or that it is weak, and that it somehow interferes with the wage earning capacity. In the old cases there is a history of an injury to the wrist which was regarded and treated as a sprain. In some cases there was some accompanying fracture, usually a Colles', which was treated while the scaphoid fracture was not recognized and was neglected.

There is a great deal of pain associated with any attempted movements of the wrist, especially those involving pushing with the extended hand or twisting. The patient is unable to turn door-knobs, must be very cautious in writing, and cannot participate in any games involving the use of the wrist. Often a sudden twinge of pain will cause the mechanic to drop his tools. All active and passive motions of the wrist are limited, particularly extension.

Attempts to continue passive motion beyond a certain limit will result in a muscle spasm similar to that in tuberculous disease. Even after many years while the pain is of lessened intensity it is sufficiently troublesome to interfere with the patient's work.

The first sign, as a rule, is swelling; it appears almost instantly after the injury. It is very characteristically marked in the region of the anatomical "snuff box." In the recent cases it is of greater degree and more extensive, but even then it tends to be limited to the radial side, never surrounds the whole wrist, and never obliterates the folds of the wrist. In the old ununited fracture there is still some swelling which is even more definitely limited to the "snuff box" region. A comparison with the uninjured side rarely fails to bring this swelling to the notice of the examiner.

Palpation will elicit severe tenderness localized exactly over the scaphoid, that is, in the anatomical "snuff box" when the wrist is in ulnar deflection. The exact localizing of the tenderness helps to differentiate this fracture from other fractures above or below the scaphoid.

Another reliable sign is the one known as the Vaughan⁽⁶⁾ knuckle percussion test, which is carried out as follows: The metacarpophalangeal joints of the affected hand are flexed, and the head of each metacarpal bone is tapped smartly with an ordinary rubber percussion hammer. The presence of a fracture of the scaphoid will be

manifested by severe pain only when the head of the second metacarpal is struck, and absent when any other is tapped, while lesions of the semilunar will give pain when the third metacarpal is struck. The anatomical relations of these bones easily explain the phenomena of the test.

Hofliger⁽⁷⁾ found shortening of from five-tenths to one and five-tenths cm. in the measurement from the radial styloid to the end of the second metacarpal bone, but Todd emphatically states that in all cases he found the measurements in both sides exactly the same. John B. Murphy found shortening in only fractures of the second type, fractures with impaction.

Echymosis was never observed, because all the bleeding, which is rather small in quantity, remains within the capsule and does not reach under the skin.

Crepitus is as a rule absent on account of the little motion allowed the fragments.

Todd never found any local wasting associated with even the most long-standing of his cases, while Murphy claims wasting as one of the usual sequelae in the long-standing untreated cases.

X-RAY DIAGNOSIS OF SCAPHOID FRACTURES

Owing to the peculiar shape and position of the carpal scaphoid the x-ray shadow is entirely apt to be deceptive, and without a proper technique it is very easy to overlook a fracture or to diagnose one where none exists. The bone may roughly be considered to consist of two thickened end-ports united by a third middle portion, known as the neck or waist. It is placed obliquely in the dorso-palmar direction so that it makes an angle of about forty-five degrees with the long axis of the forearm. Adduction of the hand, that is, the hand turned toward the ulna, diminishes the obliquity and both ends are in about the same plane, more or less parallel to the palm, while abduction increases the obliquity and makes the bone almost vertical to the plane of the palm. With the palm down on a flat plate in the abducted position the shadow of one thickened end will overlap that of the other, and will give the appearance of two separate pieces. Often the overlapping will cause the appearance of a notch, which will even further mislead to a wrong diagnosis of fracture. Then the appearance of the thin shadow of the neck between the more prominent ridges may also give the impression of a fracture.

Codman and Chase, therefore, lay down a precise standard technique. According to them both hands should be

placed side by side, palms down, the hands should be as much ulnar deflected as possible, the tube placed in the mid-line and should reach over to the knuckles. They advise the taking of radiograms in different positions and angles, to determine the exact direction of the plane of fracture.

Todd advocates in doubtful cases the use of the fluoroscope for the reason that where the plane of the fracture is not at right angles to the surface of the plate and to the incidental rays, the rays will not pass along the plane of the space between the fragments and the presence of a fracture will not be recognized. But when the hand is slowly turned under the screen from the fully supinated to the fully pronated position there must be, at some stage, a moment when the rays will pass along the plane of the fracture space and appear as a bright band of light between the two shadows of the fragments. This precaution should be taken, particularly because of the fact that there is very little displacement in this fracture.

Tyler advocates the use of stereoscopic views in all cases of wrist injuries. He finds fractures in the stereoscopic view which were missed otherwise. Todd especially advises the use of stereoscopic views in cases where the fracture of the scaphoid is merely a part of the complicated injury of the carpus.

VARIATION OF THE SCAPHOID BONE

The possibility of some variations in the scaphoid bone, that some scaphoids normally consist of two separate portions, or even of three, must be taken into consideration in the interpretation of radiograms. Pfitzner⁽⁹⁾ in his study of the comparative anatomy of the carpus, found that some scaphoids consist normally of two or three parts. The bipartite consists of radial and ulnar bones, the tripartite has radial, ulnar, and central bones. Pfitzner also advances that even the normal one-bone scaphoid has two or three centers of ossification, which later in life become united by intervening cartilage, and when the cartilage fails to unite, there results the rare bipartite or the still rarer tripartite scaphoid. He investigated one thousand, four hundred and fifty-six wrists and found nine (seven left, two right) completely bipartite, and twenty-nine (fifteen left, fourteen right) partially cleft scaphoids. This observation has been confirmed by a number of independent observers. Gruber⁽¹⁰⁾ found four bipartite and one tripartite scaphoid among three thousand wrists dissected. Von Wyss⁽¹¹⁾ saw in cretins two centers of ossification in the scaphoids of both sides. Woolf⁽¹²⁾ cites a case of bipartite

scaphoid, bilateral, discovered accidentally with no history of injury, and no disabling symptoms in normally functioning wrists. But Codman and Chase state that in looking over one thousand and forty radiograms of wrists not one divided scaphoid was found without a history of injury. Todd admits that partition of the scaphoid does sometimes occur as a developmental reversion. Thomas Dwight⁽¹⁴⁾ maintains that the normal one-bone scaphoid is very rarely fractured, and that most fractures of the scaphoid occur when violence is applied on a bone composed of two pieces united only by cartilage.

DIAGNOSIS

In many cases the diagnosis can be made by the history and clinical findings alone, but a radiogram and fluoroscopy of proper technique are decisive. Clinically a suspected fracture of the scaphoid must be differentiated from the following lesions:

(1) Simple fracture or crack of the lower end of the radius. This fracture is particularly apt to cause confusion because, as Codman points out, such a fracture or crack on the dorsal lower end of the radius is likely to rupture the common bursa or sheath of the neighboring tendons, which fills with blood and appears as a triangular fluctuating swelling over the site of the scaphoid. Careful palpation, however, will show the maximum tenderness in the lower end of the radius and not the anatomical "snuff box."

(2) The question of various forms of arthritis may arise in long-standing cases. But a careful history, consideration of various etiological factors, a careful attention to physical signs, and ultimately a radiogram, will definitely differentiate the condition.

(3) Tenosynovitis or inflammatory carpal bursitis, can usually be eliminated by a history of limited use rather than over-use, by different distribution of tenderness and absence of characteristic crepitus of tenosynovitis.

(4) True "sprain" of the wrist or traumatic tenosynovitis, presents greater and much more diffuse swelling. But it is the opinion of most surgeons that true "sprain" of the wrist is extremely rare.

SUMMARY

(1) "Sprains" of wrist which do not promptly recover are often fractures or dislocations of carpal bones. A very frequent injury is the fracture of the carpal scaphoid and it complicates fractures of the lower end of the radius.

(2) Colles' fractures, which do not respond to the proper treatment, should be examined for the presence of a scaphoid fracture.

(3) Simple fractures of the scaphoid give a definite clinical picture, viz., a characteristic history, definite symptoms and physical findings.

(4) Only radiograms made with a proper technique are reliable and ultimate. The fluoroscope should be employed in addition in doubtful cases.

(5) In interpretation of radiograms of the wrist the possibility of a bipartite or even a tripartite scaphoid should be taken into consideration.

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EDITORIAL

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Scientific Research—Or the Social Whirlwind

SCIENTIFIC research is now recognized almost universally as a condition prerequisite to intelligent planning and the sensible administration of practically every human relation save the one of individual health and happiness and their composite expression in the social welfare.

As demonstrating the greater respect scientists are accorded on the continent, attention is called to a somewhat aromatic nosegay offered by the editor of *Muenchener Medizinische Wochenschrift*, who

"Insists that German medical men support the plea for *making English compulsory*"

in the preparatory schools of Germany on the ground that

"Since scientific research in the United States has made such advances * * * and since American literature is on the point of taking the lead in medicine, a knowledge of English has become indispensable for the research worker."

As an aside, he adds:

"English is the predominant language on four continents, and since German medical men may be long debarred from settling in French speaking countries, it must obviously be to their advantage to be familiar with English."

It would seem, then, that enough has been said to support the conclusion that medical science is being impressed every day with the social obligation to either assume a vigorous attitude concerning the value of scientific research as a method for discovering answers for numerous social ills, or suffer whatever penalty may be inflicted by those men and women who are conscious of the fact that they are the playthings of a social whirlwind, men and women who are beginning to recognize the scientific fact that a whirlwind, natural or social, can always be traced directly to a vacuum as the producing cause.

Very naturally, such a sweeping assertion will breed disputants. But one cannot attempt to visualize the present social tumult without realizing there is great need for some method which will sift the social jetsam through to a common purpose; and without realizing, too, that there is but one method sufficiently comprehensive, sufficiently elastic, and sufficiently deliberate in its search for the truth, to hold any promise of reducing the social chaos.

Speaking broadly, all scientific research must be organized deliberately; permanent records of its struggles and achievements must be established in order to insure the con-

tinuity of scientific labors; and scientific research itself must always be subjected to intelligent and constructive criticism.

A SCIENTIFIC OBLIGATION

The interest of the Radiologist in this broad statement of the problem is obvious when it is remembered:

1. That the correct value of medicine is exactly in proportion to its influence upon the social body as demonstrated in individual health, usefulness and happiness.
2. That the Radiologist is first a medical man, and as such in the practice of his science must draw constantly, intelligently and fully upon the sciences of pathology, biology, bacteriology, physiology, chemistry, physics, and electrical engineering.
3. That the present chaotic condition in the practical application of the science of Radiology is due, not to the failure of individual energy and sacrifice in scientific research, but entirely to the fact that no organized effort has been made by medical men interested in the subject to bring together in their proper relation the findings of individual labor, that is, the pathological, the physiological, the biological, the chemical, the bacteriological, the physical, and the electrical.

THE RADIOLOGIST'S PROBLEMS

With these thoughts in mind, it seems well at this particular juncture, to state specifically the most important problems before the Radiologist today, problems whose solution must be determined if the Radiologist is to function intelligently and effectively in the daily application of his science to the human family:

1. The biological action of radiation on normal and abnormal tissues.
2. The dosage required to obliterate each kind of cancer.
3. Action of massive treatment on the blood forming organs.
4. Cause of radiation sickness.
5. What quality of x-rays is best adapted for each kind of treatment.
6. Determination of the best kind of filter to produce desired rays.
7. Devising of methods for the prevention of delayed radiation reactions.
8. Standardization of dosage in accordance with known factors through the employment of a full-time physicist capable of testing machines in place and giving instructions to individual operators concerning biological reactions produced by different dosages.

Even a cursory examination of these problems will disclose that no other branch of medicine draws so much on all the other sciences as does Radiology. It would seem, also, to be an indisputable fact that the practicing Radiologist can never hope, as an individual working single-handed, to master all the other sciences to that point where he will be capable of making his own scientific explorations, establishing certain absolute factors, and applying them in the

solution of the problems he must inevitably meet as an intelligent and conscientious therapist. On the contrary, his only hope lies in his ability to establish contact with reputable workers in each of the sciences, and by collaboration with them, to bring to his clientele the ultimate in scientific knowledge as it is developed and established from day to day.

Commenting on the present social delirium, H. J. MacKinder, M. P., of London, former Director of London School of Economics and Finance, makes the statement that:

"All specialization contains the seeds of death; the most daring army must, at times, wait for the supply columns to come up."

Without any thought of aspersion, that seems to be exactly the condition in which Radiology stands at the moment—it has grown to its present state of respectability and reputability as a diagnostic aid and therapeutic agent through the irrepressible energies and sacrificial labors of a comparatively few men, men like William Duane of Harvard University, Frances Carter Wood of the Crocker Institute of New York, C. R. Bardeen of Wisconsin University, Kennon Dunham of Cincinnati University, George Pfahler of Philadelphia, Preston M. Hickey of Detroit, A. S. Warthin of Ann Arbor, W. E. Petersen of Illinois, A. C. Ivy of Loyola University, W. D. Coolidge of Schenectady, N. Y., A. W. Erskine of Cedar Rapids, Ia., G. W. Stewart of Iowa University, etc., etc.—men who have labored unceasingly year in and year out in order that the science for which they hold a consuming passion might assume direction and purpose and dignity in the annals of medical attainment.

These men, perhaps, more than anybody else, appreciate the need for collaborated and co-ordinated effort among all research workers if the science of Radiology is ever to discharge its full obligation as a diagnostic aid and therapeutic agent.

RESEARCH NOW IN PROGRESS

The following resume of original research work now in progress in the United States, with a subjoined statement showing the reputable medical universities, colleges of liberal arts and other scientific agencies which have already signified their willingness to co-operate with The Radiological Society in its research activities, will establish beyond question the value of, and opportunity for, co-ordinated and correlated scientific research in its relation to the science of Radiology:

1—Harvard University, Dr. William Duane, Professor of Bio-Physics.

"Research has had to do with high tension x-ray plants and x-ray spectra, which are produced by them under various conditions of voltage, current, filtration, distance and direction from tube. Are planning the study of character of the radiation at different points in a 'water phantom' and also of the amount of radiation, in terms of our method of measurement required to produce given effects in tissues (erythema dose, dose required to destroy various kinds of tumors, etc.) Also plan to study the changes produced in the blood picture due to this penetrating radiation."

2—Wisconsin University, Medical School, Dr. C. R. Bardeen, Dean.

"Cardiac radiology is being carried on at Madison especially from the physiological standpoint. The study of cardiac output demonstrated in animals and man, instantaneous pictures at two or more periods within a given heart cycle checked up by electrocardiograph tracings."

3—University of Illinois, College of Medicine, Dr. W. F. Peterson, Professor of Pathology and Bacteriology: "Mobilization of enzymes following tissue irradiation. Possible activation of glands of internal secretion. Effect of irradiation on remote pathological lesions and acute diseases. Using dogs for experiment."

4—University of Michigan, College of Medicine, Dr. A. S. Warthin, Professor of Pathology:

"Pioneer research work in effects of x-rays on blood forming organs. Following study of changes in irradiated human tissue with special effort to discover any specific changes that may arise from such irradiation."

5—University of Iowa, College of Liberal Arts, Dr. G. W. Stewart, Professor of Physics:

1. Scattering of x-rays by light atoms.
2. Investigation of the absorption and emission spectra of the K and L series of tungsten.
3. An investigation of the tungsten x-ray emission and absorption spectrum with a vacuum spectroscope.
4. Spectra of gases excited by high frequency potentials.
5. A direct measurement of the principal reflective powers of crystals of selenium and tellurium.
6. A new method for the determination of the optical constants of metals in the form of small crystals, with results, especially in the ultra violet.
7. Magnetic rotary dispersion in colloidal solutions.
8. On the optical constants of certain crystals.
9. Thickness of thin films and the Hall effect therein.
10. An investigation into the behavior of various dielectrics when carrying alternating currents.
11. Action of cylindrical coils carrying high frequency current.
12. Electric phenomena in gaseous discharge produced by high frequency potentials.
13. Mathematical investigation of the motions of electrons and ions under the action of various types of electric fields.
14. The theory of acoustic wave filters.
15. The phase change in acoustic wave filters.
16. Acoustic wave filters; extension of experimental filters to unequal and alternating sections.
17. The attenuation factor in a low-frequency-pass-acoustic filter.
18. The action of conical horns.

6—Loyola University, School of Medicine, Dr. A. C. Ivy:

"At present at work on 'Studies on the Effect of X-ray on Glandular Activity'."

7—University of Cincinnati, College of Liberal Arts, Dr. Louis T. More, Department of Physics:

"Thoroughly equipped to carry on research in the radiological discharge of electricity through gases both with apparatus and with men who have specialized in this field. At present engaged in research work in determination of crystalline structure of metals, x-rays in surgery and absorption of very short x-rays. Are offering a special course on theory and practice of x-ray discharge of electricity through gases. 'We have developed here

- a course tending to train experts in this work, especially medical students, in our thoroughly equipped medical college, to become experts in x-ray work, and we are also offering special courses leading to the training of experts in these general subjects to those who are not in the medical college."
- 8—Leland Stanford University, Liberal Arts and Sciences, Dr. L. Webster, Professor of Physics:
"Research work being carried on in Department of Roentgenology."
1. Development of modification of Hull type high tension rectifier.
2. Clinical studies in:
(a) Spinal arthritis.
(b) Pelvimetry.
(c) Orthodiagraphy of the heart."
- 9—University of Kansas, Liberal Arts and Sciences, Dr. F. E. Kester, Dean of Physics:
"Experimental equipment consists of Coolidge apparatus—interest centers on purely physical aspects of x-ray phenomena, crystallography, wave length, etc., rather than around therapeutic aspects."
- 10—University of California, College of Liberal Arts and Sciences, Dr. Elmer Dershem, Professor of Physics:
"Have recently completed the construction of a very high grade x-ray ionization spectrometer with the auxiliary apparatus for maintaining exact control of the penetration and intensity of the x-rays emitted by the x-ray tube. This apparatus has been used in making precision measurements of mass absorption coefficients of various substances for x-rays of different wave lengths. This work is not yet completed. In addition, the department is constructing a couple of x-ray spectrographs. One a vacuum spectrograph for soft x-rays and another for use with the more penetrating rays. The purpose of these instruments is to enable us to measure the wave lengths of the characteristic lines of x-ray spectra with more precision than has been done by others heretofore, and we also hope they will enable us to discover lines not previously found. In addition, Dr. Dershem and Dr. Paul Kirkpatrick are endeavoring to secure a measure of the amount of polarization produced in a beam of x-rays by reflection from a crystal."
- 11—Washington University, College of Liberal Arts, Dr. Arthur Compton, Professor of Physics:
"Principal interests in connection with the measurements of secondary x-rays lie:
1. Examining the nature of secondary x-rays to see what part of it is scattered and what part is fluorescent in character.
2. On intensive investigation of the scattering of x-rays with the object in view of determining the arrangement of the electrons in atoms and the size of the electron and certain minor problems which naturally accompany these investigations."
- 12—Rush Medical College, Dr. John M. Dodson, Dean, Dr. Cassie B. Rose, Instructor in Roentgenology:
"Our particular field here is the correlation of x-ray and clinical and pathological findings inasmuch as a great deal of the material of the hospital (Presbyterian) and College is suitable and available for this work."
- 13—Dr. Kennon Dunham, Cincinnati Tuberculosis Sanitarium, conducted under the direction of the Cincinnati University:
"We are carrying on at present the following work: (1) The determination of the normal chest of the child between 6 and 10, from a physical examination and x-ray plates; (2) Studies of the pathology of x-ray densities within the lung, and (3) Absorption of tuberculous exudates."
- 14—Dr. George Pfahler of Philadelphia, in co-operation with Drs. Kolmer, Schamberg and Case:
"Studies of the clinical values of radiation in mouse cancer."
- 15—Dr. A. W. Erskine of Cedar Rapids, Iowa, in conjunction with Coe College and St. Luke's Hospital:
"Studies in pure physics concerning technique, apparatus, protection, etc."
- 16—Dr. C. A. Donaldson, Minneapolis, Minn.:
"Keeping blood record daily during treatment, chemistry before and after. Has partly completed experimental films, showing various voltages through 1, 2, 3 and 4½ copper, using a fresh meat bone with voltages from 50 to 200,000 at 50 cm."
- 17—Dr. Clarence F. Ball, Rutland, Vermont:
"Uncompleted studies in the metabolism of amino-acids in patients suffering with cancer, and the change which x-ray brings about in the difference between normal metabolism and abnormal metabolism in the patient."
- 18—Dr. M. J. Sittenfeld, New York City, working in Department of Pathology, Columbia University:
"For the past twelve years conducting cancer studies for purpose of determining tumor growth after injection of radiated tumor emulsion and for past five years experimenting with photodynamic substances in combination with radiations of short wave lengths. Preliminary report almost completed."
- 19—Columbia University, Crocker Cancer Institute, Dr. Francis Carter Wood, Director:
"In reply to your letter of February 25th, regarding the establishment of a Research Department of The Radiological Society of North America, I beg to say, that the Institute of Cancer Research is carrying on a large amount of experimental research on the physics underlying the treatment of cancer by x-ray and radium, such as the determination of the killing dose of tumors, the effect of different filters, the study of scattering effects, absorption in the tissues, etc., with an idea of ultimately being able to discover a method by which x-ray dosage can be accurately measured for clinical use."

SCIENTIFIC AGENCIES LISTED

Listed below are those Medical Universities, Colleges of Liberal Arts and Sciences, and other scientific agencies which have to date signified their willingness to co-operate with The Radiological Society:

MEDICAL UNIVERSITIES

Boston University	Illinois University
California University	Indiana University
Cincinnati University	Kansas University
Columbia University,	Leland Stanford University
Crocker Cancer Institute	Loyola University, Chicago
Cornell University	Marquette School of Medicine
Creighton University	cine

Dartmouth College
 Detroit College of Medicine
 George Washington University
 Hahnemann Medical College
 Harvard University
 Howard University

Michigan University
 Missouri University
 Ohio State University
 Oregon University
 Rush Medical College
 Vanderbilt University
 Washington University
 Wisconsin University

COLLEGES OF

LIBERAL ARTS

Boston University
 California University
 Cincinnati University
 Coe College
 Emory University
 George Washington University
 Iowa State University
 Johns Hopkins University
 Kansas University
 Leland Stanford University
 Louisville University

Michigan University
 Minnesota University
 North Dakota University
 Northwestern University
 Ohio State University
 St. Louis University
 Utah University
 Washington University
 Wisconsin University
 Yale University
 (Sloane Lab.)

SCIENTIFIC AGENCIES

United States Bureau of Standards
 Medical Division National Research Council
 National Dental Association
 St. Lukes Hospital, Cedar Rapids, Iowa
 Hahnemann Hospital, Philadelphia
 Central Illinois Radiological Society
 Detroit Research Club
 Milwaukee Research Society
 Cincinnati Tuberculosis Hospital

PROFFERED ASSISTANCE

Collis P. Huntington Memorial Hospital, Harvard Medical School, Boston.—February 28, 1922.

"Let me congratulate you and The Radiological Society upon the interesting and exceedingly important activity which you are planning to carry through.

"I am sending you the following notes and would be glad to give more details if you desire it.

"1. We are now carrying on researches on high tension x-ray plants and on the x-ray spectra which are produced by them under various conditions of voltage, current, filtration, distance and direction from tube, etc. These researches are designed to furnish data of a fundamental character for the deep x-ray therapy. So far, these have been carried on in the Physical Laboratory of Harvard University. We are now moving into a new laboratory, however, built for the purpose by the Cancer Commission of Harvard University.

"Among other things, we have developed a new method of measuring both the intensity and the penetration factors of an x-ray beam. The intensity factor is measured by means of an ionization chamber, and, as an estimate of the penetration factor, we take the average or 'effective' wave-length of the beam and determine it quickly by estimating the thickness of aluminum that absorbs the same fraction of the radiation that a given thickness of copper absorbs. From this thickness of aluminum, we read off the 'effective' wave-length by means of a curve.

"2. As soon as the x-ray plant has been installed in the new building we expect to begin a systematic study of the character of the radiation at different points in a "water phantom," and also of the amount of radiation, in terms of our method of measurement, required to produce given effects in tissues (erythema dose, dose required to destroy various kinds of tumors, etc.) We are also planning to make studies

of the changes produced in the blood picture due to this penetrating radiation.

"3. The apparatus and funds for carrying on the work come partly from the Cancer Commission and partly from the Department of Physics of Harvard University. At present I have \$2,400 for salaries of assistants and about \$1,500 for other expenses with occasional grants for special purposes. I divide the \$2,400 into three parts and appoint two part-time students as assistants and one full-time young man who does the routine work required. There is also a roentgenologist at \$2,500 a year, who will supervise actual treatment, but he will probably have very little time for research work. These funds and personnel are grossly inadequate for carrying on the work as rapidly and effectively as I would like to do, but one has to do the best he can with the means at his disposal.

"4. I find that the most pressing financial need is for suitable assistants to carry on the work. It is not difficult to get money for buildings, especially in connection with the cancer problem, but the funds required to run the plant, especially to pay the necessary labor, both intellectual and manual, are not always forthcoming. I feel that I ought to have here at least one full-time man on a salary of \$2,500 or \$3,000 a year, who would be capable of carrying out suggestions without my personal supervision all of the time. The above mentioned salary is about what the Rockefeller Research Fellows in Physics and Chemistry earn. I have frequently urged the necessity of funds for this purpose on the National Research Council. This seems to be the greatest difference between the research work as carried on in America and in Europe.

"Anything that I can do to help out your committee in this important activity will be done with great pleasure."

Yours sincerely,

(Signed)—WILLIAM DUANE.

Columbia University, in the City of New York, Institute of Cancer Research.

"In reply to your letter of February 25th, regarding the establishment of a Research Department of The Radiological Society of North America, I beg to say that the Institute of Cancer Research is carrying on a large amount of experimental research on the physics underlying the treatment of cancer by x-ray and radium, such as the determination of the killing dose of tumors, the effect of different filters, the study of scattering effects, absorption in the tissues, etc., with an idea of ultimately being able to discover a method by which x-ray dosage can be accurately measured for clinical use.

"I shall be very glad to co-operate in any way with the Research Committee of the Radiological Society, and have an ample staff for the carrying on, at the request of the committee, of any type of work which seems worth while, provided that any excessive expenses can be met. Our own funds are wholly involved in the programme of experimental work already laid out."

Very sincerely yours,

(Signed)—FRANCIS CARTER WOOD, Director.

March 27th, 1922.

"I most heartily approve of this step to further research by The Radiological Society and we may heartily approve of these efforts of the chairman. Be assured of my most hearty co-operation. Not only can this effort help research, but it can help to place the x-ray work of the United States upon a footing with the best research in our country.

"There is no field of medicine which presents so many possibilities in research work. Let me give you an example as to how your efforts could help in Cincinnati. I am mak-

ing this suggestion as a concrete example of how a little money, combined with the approval of our society, can be made to go a very long way. I am not asking that you enter into this research unless it appeals to your committee. I am using my present needs as an example to show you how I think the greatest good can be obtained with the least money.

"I am sure that great benefit can be obtained by treating selected tuberculosis patients with the x-ray. Much experimental work has been done upon animals and more is to be accomplished.

"I lack two things at the Cincinnati Tuberculosis Sanatorium—first, high tension equipment; but this will be of no avail unless I can secure the services of an adequate technician who can devote the necessary time to blood chemistry, metabolism and differential counts.

"Suppose, in the judgment of your committee, such a research was considered worthy of real scientific effort, and that you could write a letter addressed to the President of our University stating that you would be able to put a certain sum of money (\$1,200) yearly to secure the services of a trained technician provided that board and room would be furnished for a period not to exceed two years. If such a letter could be written I am sure that private funds would soon furnish the equipment, and the University and the Tuberculosis Sanatorium would quickly arrange the necessary accommodations and the work could be started within sixty days.

"Thus, we would have, free of charge, the services of the Pathological Department, the Medical Department, the use of 250 patients from whom to select suitable cases, a complete animal house with the necessary care of the animals, all for the cost of the technician.

"The capital for the machine would be easier to raise by private subscription than the salary of the technician, and the routine work of our hospital is so heavy that the two technicians whom we are allowed could not possibly take on this added labor.

"The experimental work which Dr. Rogers and I have already done indicates that this offers great possibilities in the treatment of selected cases of tuberculosis, but in any case where there is much caseation x-ray treatments seem to be detrimental.

"To do this work adequately a great number of tests must be made for a great variety of treatments, because we do not know at present any of the factors of the x-ray dose, nor the frequency with which they should be repeated. We have pretty well determined that the reaction upon the mononuclear cells of the blood is the yard-stick, which must be used to determine this dosage. Dr. Samuel McIntosh of the Physics Department of the University, who worked for many years with Rutherford, has agreed to help me with the physics if we are ever able to undertake this experiment.

"In answer to the questions of your former letter, I would say:

"First—A. We are carrying on at present the following work: The determination of the normal chest of the child between 6 and 10, from a physical examination and the x-ray plates.

"B. We are continuing to study the pathology of x-ray densities within the lung.

"C. We are finding some very interesting notes upon the absorption of tuberculous exudates.

"In answer to question (2) you have my dream for the future.

"In answer to question (3) we have the personnel and the funds for everything except the equipment of a large machine, which I know can be obtained, and the funds

necessary for the technician. I am sure that this would take less than \$1,200.

"Question (4): I can only suggest that in my judgment the best work can be obtained with the least money, by aiding research under way, than by trying to create new research laboratories.

"Be assured of my hearty co-operation in any way within my power. In my judgment, this is one of the biggest things that any organization can undertake.

"With much esteem, I remain,"

Cordially yours,

(Signed)—KENNETH DUNHAM.

The University of Wisconsin, Madison—Jan. 26th, 1922.

"1. As a rule I think more can be done by aiding research already under way than by outlining problems and trying to find some one to carry them out. Therefore, in answer to your first question I should say that the best thing would be to collect data not only on what work is now being carried out, but on estimates from the workers in various fields as to what funds they are urgently in need of in order to carry the work out effectively. The Central Committee should then determine to which of these projects such funds as are available might be devoted. This also answers your second question.

"3. If the department has a list of the scientific work in radiology being carried on and a list of financial needs for furthering this work, the central committee can do a great deal in furthering those lines of investigation which appear most promising, provided they have funds at hand.

"The work in radiology being most actively carried on in this university at the present time is in the field of cardiac radiology, especially from the physiological standpoint. The study of cardiac output, as demonstrated in animals and man, instantaneous pictures at two or more periods within a given heart cycle checked up by electro cardiograph tracings, are similar problems.

"4. It seems to me highly probable that there are numerous lines in radiology in which combined work could be carried out to advantage. A central committee would be very helpful in encouraging this. This would be especially true of statistical data, and any investigator desiring more statistical data than he can readily command should communicate with the central committee. The central committee would in turn communicate with those workers who the committee feels would be helpful in such co-operative work.

"I shall certainly be most happy to aid in any way I can the work of the committee, which I feel is highly important. I am more and more impressed with the splendid vigor of The Radiological Society.

"With best regards,"

Sincerely yours,

(Signed)—C. R. BARDEEN.

University of Cincinnati—March 23, 1922.

"I have been very much interested in your proposition from the beginning, but have simply postponed getting down to writing out the details.

"The Department of Physics of the University of Cincinnati and I personally are quite ready to co-operate with your society in promoting its purposes. I am certain that we can do our share of the work, as we have for many years devoted much time to this subject and have published many articles dealing with it. We are thoroughly equipped to carry on research in the radiological discharge of electricity through gases, both with apparatus and with men who have specialized in this field. On the purely scientific side we are at present engaged in research work in the de-

termination of crystalline structures of metals, x-rays in surgery, and the absorption of very short x-rays. We offer a special course on the theory and practice of x-ray discharge of electricity through gases.

"We have developed here a course tending to train experts in this work, especially medical students, in our thoroughly equipped Medical College, to become experts in x-ray work, and we are, also, offering special courses, leading to the training of experts in these general subjects, to those who are not in the Medical College.

"Thus, you see, we are in a position to take up any problems that you may think it wise to suggest to us and to enter into the plans of your society."

Yours very truly,
(Signed)—LOUIS T. MORE.

Loyola University School of Medicine, 706 South Lincoln St., Chicago—March 22, 1922.

"We are heartily in favor of your plan and believe that it will do more to stimulate research in radiology than any other plan that might be devised by The Radiological Society or any other organization. It is an excellent idea.

"We are intensely interested in radiological research from the physiological standpoint. The problem that we are working on at the present time is 'Studies on the Effect of X-Rays on Glandular Activity.' We have practically completed the work on the submaxillary gland and are now working on the gastric glands. We will next study the testis.

"As the above problem is very inclusive, no other problem will be undertaken for some time.

"The personnel working on the above problem at present consists of myself, Dr. Orndoff and two student assistants.

"Our apparatus is limited in amount and any deficiency in apparatus is overcome by a loan of apparatus from the supply of Dr. Orndoff.

"We have no funds at our disposal for our work. The work is being done because of our interest in it. The student assistants at present receive no pecuniary compensation for their endeavors.

"I am of the opinion that it would be well for the committee or a permanent secretary to distribute the money that the society has for the purpose of research in the form of grants. Before making such a grant the conditions in each laboratory should be investigated by the committee or a permanent secretary. Such a plan would place funds not only where they are needed, but also where they will yield the greatest returns. Such a plan of grants might be supplemented by the condition that the grant will be increased provided the laboratory or the university concerned would add a certain sum to the grant.

"Asking your pardon for the trouble caused you by my delay in answering your previous communication, and wishing the greatest success to attend you in this wonderful and far-reaching program, I am,"

Yours truly,
(Signed)—A. C. IVY.

University of Michigan, Ann Arbor—March 29, 1922.

"In reply to your letters presenting the plans which The Radiological Society are fostering for collaboration in research, I should like to say that this Department looks with favor upon any such undertaking.

"We are just establishing an x-ray outfit for research purposes, and have one graduate student doing work at the present time. Professor Lindsay, who will be in charge of the x-ray work of the Department is at present abroad and will not return until the beginning of the coming college year.

"Within a year the department will move into a new laboratory, and we expect at that time to have an equipment which will permit us to do very effective research in x-rays.

"I have believed for some time that one of the most promising fields for research lies between physics and the biological sciences, including medicine, and I should be glad to foster work in which the Department of Physics and Medicine would collaborate. Due to the fact that my own interests are in other fields and that our work in x-rays is only under way, I haven't definite suggestions to make other than the general ones which I have just stated.

"I shall appreciate it if you keep me informed of the progress which the society is making in this particular."

Very sincerely yours,
(Signed)—R. M. RANDALL.

University of Michigan, Ann Arbor—March 3, 1922.

"Replying to your letter of February 27th, I have always, personally, been interested in the effects of x-rays and radium upon the human tissues, and have always made it a point to study as thoroughly as possible any irradiated tissues that are sent into the laboratory for diagnosis.

"You may be aware of the pioneer work that I did in the effects of x-rays upon the blood forming organs. This was done independently of the work of Heineke, although his was published a few months earlier, while my paper was still in press. His paper, as well as mine, were considered epoch-making, and the literature on x-ray pathology since that time has largely been based upon those two papers, and very little that is new has been offered since then. I am sending you reprints of my earlier papers.

"At the London Congress of 1913 I was asked to give a resume of my work and this was largely copied in foreign journals. I feel, therefore, that my laboratory has some reason to be proud of what it has accomplished earlier in this work.

"If we could obtain proper help in the way of technical assistance, or otherwise, to relieve me of some of the great detail of work that hinders my research activities now, I should be extremely glad to go at these researches more intensively. I have no special funds, but have only the general outfit of my laboratory to be used for this purpose. At the present, the one line of research in this field that I am following with interest is the study of the changes in irradiated human tissue with special effort to discover any specific changes that may arise from such irradiation. This I consider a very important thing in the field of general diagnosis, as we are constantly asked if we can see any changes in tissues resulting from such treatment.

"I should like very much to continue this work in a more intensive way if the laboratory could receive some assistance that would enable it to do so. Doctor Rollin H. Stevens of Detroit, about two years ago, offered to co-operate with us and give the laboratory the funds for such work. At that time we could find no individual to carry on the type of work that he wanted, which was to check up the cases treated by him in Detroit, and we were unable, and would still be so, to make use of such a fund under such conditions. If the laboratory could be given outright a research fund and if the published researches made with the assistance of this fund could be published from the laboratory with the statement 'assisted by a grant from The Radiological Society,' just as we publish other research work under other grants, I should be very glad to have the laboratory co-operate with the society in this way.

"We receive a sufficient amount of material that has been irradiated to give us during a year enough material for such study. As I myself am personally interested in this work that I am now doing, I should assume personal direc-

tion of it, and my especial need would be funds sufficient to employ a special technical assistant to prepare the material for my study.

"I shall be very glad to give you further information, but this is probably sufficient to begin with, and will give you an idea of how the proposition appeals to me."

Sincerely yours,
(Signed)—A. S. WARTHIN.

Indiana University—March 9, 1922.

"Dr. Emerson, the Dean of the Indiana University, has referred your letters to me in regard to research along the science of Radiology.

"I am sorry to say that the department is just being established along practical lines and we are not in our new quarters and have not had the opportunity to put radiology to so high a standard. We do, however, hope to start something along this line before long. Our equipment is of the very best and the personnel consists of two well trained, well paid technicians and myself. Dr. Cole and Dr. Smith of our office also help me out in many ways and we are all working for the ideals which your plan intends.

I am sorry that I cannot give you anything more than this, but hope to before very long.

"With kindest regards, I am,"

Sincerely yours,
(Signed)—R. C. BEELER.

University of Illinois, College of Medicine, Chicago, Ills.
March 6th, 1922.

"I am sure that we shall be very glad to co-operate with your committee in every way that you suggest, even if for the time being we will not need financial support. At the present time our laboratories are quite out of date, both in space and equipment, but as you may know, the University will within a year or two have a large building for research work and we shall then be in a position to carry out a number of experiments which so far we have not been able to do.

"(1) The problems that we have under way and in mind concern biological reactions brought about by irradiation. I do not think that we will ever take up physical or engineering problems here; the proper departments for work of that type are at Urbana and our connection is unfortunately not close. Our work has concerned the mobilization of enzymes following tissue irradiation, the possible activation of glands of internal secretion, the effect of irradiation on remote pathological lesions and acute diseases, etc. We are using dogs for the purpose, but are limited because of the crowded condition of the laboratory. Under the conditions the work can be carried on but very slowly and there will be no improvement until we get into our new building.

"(2) We have sufficient departmental funds at our disposal at present to carry on the work in its limited form. If it can later be expanded under favorable prospects we might ask some assistance in the way of salary for a half or full time research worker who could devote his entire time to the problems. Apparatus and other expense would be covered by the university funds. I believe this would give you a maximum return for the outlay and will approximate, I presume, the plan that you have in mind to aid the study of irradiation problems.

"Such a grant would not require more than about \$1,200 to \$1,500 per year for perhaps two years. At present we could not properly make use of such funds. In a few years, I believe, we would be in position to use them with profit.

"If at any time I can be of any service to you I shall be very happy to have you write me."

Very sincerely,
(Signed)—W. F. PETERSEN.

George Washington University, Medical School, 1335 H Street, N. W., Washington, D. C.—March 30, 1922.

"It seems to us that the idea of The Radiological Society of North America is an excellent one. We are not at present doing any special research work along radiological lines in this institution, but we hold ourselves in readiness to co-operate with any committee you may appoint and to undertake any work for which we are equipped. We are quite in accord with the principle you have stated that research work in the various institutions of the country should be coordinated and have some sort of general direction if that is possible. We will be glad to co-operate with you in your attempt to bring about this end."

Very truly yours,
(Signed)—W. C. BORDEN, Dean.

Department of Commerce, Bureau of Standards, Washington—December 20, 1921.

"(1) Referring to your letter of December 12th on the subject of a clearing house of information to connect members of your society and the various research institutions and research workers in the United States, we have long felt that real progress in the technique of using radiation of various kinds for therapeutic purposes was essentially dependent upon a better knowledge of the physical properties of the radiation used. If the committee which you propose to establish can secure better co-operation between your members who are engaged in the practical use of radium and x-rays or other radiation, and the research workers who have dealt with the quantitative study of such radiation, we believe it will be of very great value.

"(2) As you are probably aware, there has been so much demand for the measurement of radium preparations in connection with their sale that this bureau has been obliged to concentrate on this one kind of service practically all of the resources which it could devote to the work. Consequently we have produced very little original information on the properties of radioactive materials or of x-rays. For several years we have been trying to obtain a small special fund to begin some research in this field, but up to the present time these efforts have been in vain. There is now a fair prospect that we may obtain such a fund for the fiscal year beginning next July. If this is granted we hope to be of greater service to those members of your profession who are interested in radiological work.

"(3) Under present conditions we would not be able to contribute much which would be of interest to your journal. Furthermore, we realize that to be really useful to members of your profession, the material would need to be prepared by some one who is familiar with their problems and could put the information in suitable form for your readers. Consequently, as a specific reply to your inquiry, it seems best to say that this bureau will be very glad to co-operate as effectively as possible with your proposed committee and that we shall be glad to receive from you any suggestions you care to offer as to the best procedure for making such co-operation effective."

Respectfully,
(Signed)—S. W. STRATTON, Director.

National Research Council, 1201 Sixteenth St., Washington, D. C.—Kalamazoo, Mich., March 10, 1922.

"In accordance with the request of the chairman of the Medical Section of the National Research Council, I

named an x-ray committee. This committee was to be ready to take up any line of research which was desired because of military conditions especially, but also any other conditions in times of peace that might be brought up by the Council. There has never been any demand made upon this committee and the committee has never met. I endeavored, however, to forward the general purposes of the Research Council and made a motion in an executive meeting of the American Roentgen Ray Society to give \$1,000 as a prize for the best piece of research in the field of x-ray or radium. I also talked up the matter of a special lecture to be given at each meeting and to be named after some distinguished member of the society who had passed away. As you know, Dr. Case, during his presidency, inaugurated the Caldwell lecture.

"I was, therefore, very greatly interested in your efforts toward founding a Research Bureau. I trust that you can put this through. I would be very glad if you would use your position as a member of the x-ray committee of the Medical Section of the National Research Council, in pushing this matter."

Sincerely and cordially yours,

(Signed)—A. W. CRANE.

National Dental Association, Minneapolis, Minn.—March 8, 1922.

"Certainly, the National Dental Association and its members ought to be willing to co-operate with any and every ethical society. Research work is not for an age, but for all time, and not for an individual, but for humanity.

"The plans of the National Dental Association Research Commission are in the hands of the president and secretary of the commission. Doctor F. O. Hetrick is president and he resides in Ottawa, Kansas. Doctor R. H. Volland can be addressed at the Iowa College of Dentistry, Iowa City, Iowa.

"I am so extremely busy with the work of the whole association as its president that I have not been giving detailed attention to the work of the commission. At the present moment, the particular researches under my care are financed and we have everything necessary with which to carry them on furnished by the University of Minnesota. Thousands and thousands of dollars of good research apparatus of all types is there. I put in a budget from year to year to take care of the necessary pay of the men who carry on the work. I would think the way to co-operate with the research workers of the National Dental Association would be direct with the Research Commission. Any funds you might be able to spare for that purpose should, I think, go into the hands of the treasurer of the commission, to be apportioned by the commission itself, which consists of twenty odd men who meet yearly at the time of the meeting of the National, reporting to the National the researches under way during the past year and authorizing new researches where they see the need exists.

"Thank you for your very important letter and commend my energy at any time you see fit."

Very sincerely yours,

(Signed)—THOMAS B. HARTZELL.

SOME PERTINENT SUGGESTIONS

Harvard Medical School, Department of Physiology.

"Some time I wish that a careful worker would go over in detail the work which I did on the rate of discharge of food from the stomach and see to what degree it is true also of human cases, and in case there is some difference between the rate of discharge of carbohydrates, fats, and proteins in man and those that I observed in the lower animals,

I wish that an inquiry could be made as to how the difference can be accounted for."

(Signed)—W. B. CANNON.

Baltimore, Md.

"Research of any kind costs money. Majority of men in practice are hampered in the correct study of their own observation by lack of funds. Majority of universities are in the same condition. Therefore, if your society wishes to encourage research for the benefit of its members, they must create a research fund. Small contributions from many members will be helpful to the few who are in position to make the research for the benefit of all. Codman's scheme of the registration of bone sarcoma is a good example. The American College of Surgeons have given him \$1,500 to continue the work.

"I would suggest that The Radiological Society request its members to register every case of malignant disease treated by x-ray or radium, with or without operation, in which the patient is well five years since the beginning of treatment; then, have the data submitted to a committee to verify the diagnosis and decide whether it is correct."

(Signed)—J. C. BLOODGOOD.

Detroit Medical College

"Expressing my personal opinion in the matter, I feel with others that the society should attempt the problems which can be solved only by the closest expert study. There are, as I see it, two fields, that of clinical research, and that in the domain of physics. The former is the particular field of the medically trained man; the latter largely that of the physicist. I would not attempt to speak for the second class. It seems to me that we are largely in need of well written text books. This means a thorough sifting of the papers which have appeared from time to time in the various radiological journals within the last five years.

"It seems to me also that the time is ripe to attempt to crystallize the opinions of the profession in the matter of radium and x-ray therapy."

(Signed)—J. H. DEMPSTER.

University of Utah

"The present day layman is in a way aware of the beneficent results of scientific investigation, but he is too much inclined to give undue credit to the spectacular and not enough to painstaking study. The surgeon is rated higher than the careful scientific diagnostician. The x-ray photographer is too often paid at a rate far in excess of the physician who diagnoses the cases. So many men who sign themselves roentgenologists are nothing more than x-ray photographers.

"The writer has made hundreds of x-ray exposures and believes the skill and knowledge necessary to do this work is really less than that required to make a good photograph. In any case the mere taking of x-ray pictures is such a simple matter that the ridiculous charge of \$50.00 for a chest or pelvis seems an exorbitant extortion when perhaps the physician is getting ten dollars for making the diagnosis.

"This difference between the spectacular and real scientific analysis is a matter which I believe the Radiological Society proposes to set before the public. I hope some distinction can be made between the man who operates the switches and the student of the x-ray plates."

(Signed)—ORIN TUGMAN, Professor of Physics.

The Ohio State University

"Taking up more specifically the points mentioned in your letter upon which you welcome suggestion, I believe that you must maintain a large publicity bureau to educate

the public concerning the truth of radiation therapy. Such a bureau must be intellectually honest, not afraid to say that radiation fails in cases where it manifestly does fail, but also not afraid to combat such distortion as that referred to in Dr. Williams address as given by the Associated Press.

"As I see it, what we need is not so much more agencies or institutes of any kind, but a correlation and co-operation between the existing agencies. Physicists and radiologists have got to work together more and means have got to be found to enable them to do that. Radiologists working above 100,000 volts have certainly got to have more understanding than in the past upon the physical and electrical engineering problems involved in the proper control and measurement of the voltage, x-ray dosage, etc.

"I am just installing an x-ray power plant at this laboratory that will enable me to obtain 50,000, 100,000 or 200,000 volts. When it is installed it will be possible for our pathologist, Dr. Ernest Scott, to submit rats and guinea pigs having cancer to x-ray radiation, thus experimenting along lines similar to what Dr. Wood of the Crocker Cancer Research Laboratory is doing. Naturally, however, I intend to do some purely physical research with this apparatus, one of the problems I am interested in being an engineering problem, the x-ray analysis of various alloy steels.

"What organization ideas I have run along this line. Much of our progress of the future in science has got to be done by groups of individuals rather than by single individuals. In many cases how much more can be done by chemist, physicist, bacteriologist, pathologist, and radiologist working together than by such individuals working alone. Can't your society develop a means of bringing about the proper liaison between such scientists?"

(Signed)—F. C. BLAKE, Dept. of Physics.

University of Oregon

"I think there is a great field for study in the standardization of the therapeutic use of radium and roentgen light, which, as far as I am able to see, is still in a very formative stage."

(Signed)—RICHARD B. DILLEHUNT,
Dean, Medical School.

Yale University, Sloane Laboratory

"I should like to suggest that an appropriate study which your society could push to advantage is an investigation of what is the relative value of the various wave lengths of light and also of x-rays in the killing of tubercle bacilli. In the same connection, a study should be made of the rate at which the human body absorbs these various radiations so that it would be possible to find what is the most effective wave length for use at any depth in the body.

"That being once determined, it would be up to the physicist to devise sources of light which would be most useful for this purpose, and it may well prove that sunlight is not the most effective agent to be used for the cure of tuberculosis."

(Signed)—JOHN ZELENY.

St. Louis University

"I am scarcely in a position to offer any suggestions which are not old or well known to you already. If there is one feature in x-ray work that needs attention, it is the development of some means of determining with safety and accuracy the strength of exposure which is proper in the large variety of cases for which x-rays are used. An x-ray machine in the hands of an inexperienced doctor or of an experienced one under extraordinary circumstances, is a danger truly to be feared. But this is an old idea, and one

that you are equally convinced needs solution."

(Signed)—HUGO F. SLOCTEMYER,
Department of Physics.

University of California

"In this department we give courses on the production, characteristics and nature of x-rays and radium, but have not taken up any of the aspects of the subject which would be of the most value to the practitioner. In our medical school there are specialists in the use of x-rays and radium, but they are apparently not much interested in those aspects of the subject which interest us most. As in the case of all border subjects, it is difficult to find men who have interests sufficiently broad to see all sides of the subject. I think the most immediate problem before us is the institution of courses for the training of such men, which would have to be differentiated both from that of the specialist in physics and that of those who intend to practice radiology as an art. It is very important that this subject should have a solid scientific foundation."

(Signed)—E. P. LEWIS,
Department of Physics.

The University of North Dakota

"Our department at present is doing no research work connected with the work of the society which you represent. Personally, I feel that one line which might well be undertaken by a research department of your society would be to act as a clearing house for information, developments and research problems in your field. For example, I think it would be well worth while if at least once per year the Physics Departments of our institutions could receive a summary of the worth while developments in radiology and also a list of the research problems, the solutions of which are needed. I feel that our college departments, as for example, physics, are insufficiently in contact with the fields of application. If the department which your society is contemplating, could help to make this contact close, I believe it would be of benefit to all."

(Signed)—KARL H. FUSSLER,
Department of Physics.

The Johns Hopkins Hospital

"In reply to your letter of January 21st regarding the research department of the Radiological Society, written to me as Dean of the Medical Department of the Vanderbilt University, I wish to say that I have not as yet entered upon my duties at Vanderbilt University Medical School, nor have I undertaken any extensive planning for the x-ray work that will be pursued in the new school.

"From the general point of view of an internist, I would like to say that I feel that the most important line of research that can be undertaken in radiology is that regarding the underlying principles upon which therapeutic action of rays depends. It would be of great value to know, for instance, what the therapeutic rays have in common, and what the dosage should be. I feel strongly that this subject should be approached from a point of view of pure physics. I should like very much to see the Radiological Society undertake the problem of obtaining fundamental physical knowledge which will lead to a better understanding of the effects of various types of rays on normal and abnormal tissues. I believe this would be of far greater permanent value than the more definitely clinical and practical problems which are likely to scratch the surface, as so much radiological work has done in the past without making any deep impression."

(Signed)—G. CANBY ROBINSON,
Acting Physician-in-Chief.

The University of Kansas

"So far as I can see the problems of your society, one line of activity would be very gratefully received by Departments of Physics throughout the country. I do not hesitate to mention it, since in all likelihood the activities of this department would not put it in line to receive benefits from the fulfillment of the suggestion made; therefore, the department cannot be accused of prejudice in the matter. As you well know, one of the most serious handicaps under which research work in this country labors is lack of financial support. Very few universities are able to put into their research departments funds anywhere nearly adequate to carry on a well designed line of attack in any of the prominent fields of research. Here, then, is a field very prominent in its applications in medical and surgical science which is bringing in considerable funds to professional men who apply the results of research work. The question arises: can these same professional men afford deliberately to lay aside, each of them, a reasonable amount yearly—the members of old synagogues might call this tithing—this designed, however, to broaden the application of radiology and increase the returns to the profession! It should be looked upon as a good business investment! I cannot think of a more beneficial thing which the society could do than to establish a fund after this fashion, to administer it through a competent committee whose function would be to use good judgment in the distribution of grants from the fund to those laboratories where proficient work of research and developmental character could be carried out.

"The maintenance of a constant survey of research problems in the x-ray field, hinted at in the third suggestion of your letter of January 26th—the catalogue of problems resulting from such survey to be useful in avoidance of needless duplication of effort in various laboratories—would be a very beneficial thing. The results of this survey should, of course, be open to all institutions.

"The various laboratories of this country should be much interested in the activities of your society in keeping its members in touch with the problems of these laboratories, and I express again my appreciation of your letters of information and inquiry."

(Signed)—F. E. KESTER,
Department of Physics.

The University of Oklahoma

"It is important that the scientific basis for medicine and surgery be made as solid as possible, and this can be brought about only through research and diffusion of knowledge.

"The physics department of the University of Oklahoma is at present housed in very inadequate quarters and it is scarcely possible for us to do any research work along these lines.

"However, this places me in the position of wishing to emphasize the other side of the problem—that of the diffusion of knowledge.

"For some reason or other physics teaching in this country has been largely tied up with engineering. I do not mean that the courses are necessarily in conjunction with the engineering colleges, but that the engineering influence on text books and teaching is enormous. While I believe in the teaching of fundamentals, I do not feel that tradition should settle what the fundamentals are. Now that physics is required of all medical students we ought to teach them the fundamentals, amplified by and illustrated from the applications in medicine. Vacuum tubes, ionic theory, radioactivity, etc., should have a prominent place.

"The average teacher of physics is using what I term a text in 'physics with engineering applications and illustra-

tions,' and if he is able to enrich the course from his own knowledge and experience it is likely to be along the lines of pure physics or engineering. Very few know the medical side.

"Therefore, for the sake of the future doctors who are all *forced* to take physics, I pray that you will make one of your functions the furnishing of teachers of physics with information enabling them to enrich their courses along the lines of medical experience and applications."

(Signed)—HOMER L. DODGE,
Professor of Physics.

FUTURE POSSIBILITIES

It must be remembered that the foregoing constitutes but the results of a somewhat hurried and preliminary survey. It is not in any sense of the word conclusive. There are many scientific agencies which have not yet been approached simply because of the limitations of human flesh and blood. But a beginning has been made. From the assistance proffered, it is safe to assume there are numerous other reputable institutions, organizations, and individuals, sufficiently imbued with the true scientific spirit to be not only willing, but ready to perform their full quota in any such comprehensive and pregnant undertaking as that proposed.

As matter of fact, offers of assistance, suggestions of value, are received almost daily. It will be our pleasure to publish further data from time to time as it accumulates. In order to get to press, it has been necessary to draw the line somewhere. However, it seems safe to assume that the foregoing compendium is representative. For the moment the imperative thing would appear to be the formation of some definite policy and the creation of an elastic working organization, manned by sympathetic human beings, in order that the work thus begun under such fruitful promise may be carried on and made the foundation of a perpetual sponsor of real scientific achievement, ideals and progress.

THE PLACE OF BEGINNING

Anything like a thoughtful examination of the wealth of suggestions offered will disclose that there are two things immediately essential if the science of Radiology is to be established on a scholarly and scientific basis. They are:

1. The formation of a central bureau charged with the duty of assembly, collation, and dissemination of existing data concerning the various phases of Radiology, supported by scientific findings and case reports. Such a bureau must stand ready at all times to furnish specific data to all reputable scientific agencies and men on any and every phase of the science with which it deals.

2. The creation of an endowment fund, placed in trust, for the purpose of perpetuating scientific research designed to extend the science of Radiology diagnostically and therapeutically. Only the yearly accruals from the investment of this trust fund should be used, and that disbursed under the most careful scrutiny of men competent to judge the possibility of potential benefits inherent in the research proposed. These men will, of course, foster only those scientific projects which comport strictly with the ideals of the Radiological Society and the obligations of Radiology as a science.

Brief discussion of these two immediate problems may serve to show both their practicability and possibility. For this purpose, even at the expense of tedium, some concrete illustrations are set up.

Such a bureau should, for instance, on the subject of cancer research, assemble, compare, and check the findings of all agencies, institutions and men conducting scientific studies. It should gather data from pathologists concerning the action of x-rays, radium and electro-therapy on normal and abnormal tissues; the effects of radiation on the blood producing organs; and specific action of each kind of radiation on each kind of tumor. It should build up a symposium on the physiological causes for radiation sickness, with methods of prevention, including, of course, definite determination of the toxic causes; organ stimulation, etc.

On the purely physical side, that bureau should follow the progress of experiments looking to the establishment of absolute methods for producing radiation suitable for therapeutic work, the quality and quantity of radiation best suited for specific diseases, accurate methods for estimating dosage, and proper methods for protection of patient and operator.

By reference to a preceding subdivision, it will be patent that if such a bureau were to accomplish this result with respect only to the studies already reported in progress, to say absolutely nothing about the enormous amount undoubtedly going on which has not yet been reported and the large amount which will be instituted when those organizations interested in the development of the science evince their willingness to foster and encourage research in the various institutions which have proffered their assistance—if such a bureau in the beginning were unable to do more than this, it would render a very great service to the individual Radiologist, and go a long way toward making possible the establishment of the science of Radiology on a scholarly and secure scientific foundation. But it should go much further, and include within the scope of its inquiry the sciences of biology, bacteriology, chemistry, and electrical engineering. These sciences are equally important if the problem is to be viewed in its entirety.

Now, as to the question of funds—viewed in the sense of the sum of money which would be required to undertake all of these lines of endeavor immediately, perhaps it appears appalling. But considered as a budget, apportioned among all of the various individuals and organizations of the country directly interested in founding Radiology securely and permanently on a scholarly and scientific basis, it is anything but an impossible job.

A number of substantial offers of financial assistance have already been received from manufacturers of apparatus, equipment and therapeutic devices. But there is this one thought that is absolutely unanswerable: the members of this or any other similar organization cannot go to the outside world for financial support of an undertaking in which they are not sufficiently concerned to invest their own money. To do so would be to stultify their good name, disregard all thought of self-respect, and be in effect a disgusting offer to sell their birthright for a mess of pottage. Such an undertaking as the one in contemplation can never succeed on any such basis.

There are in this organization alone, approximately seven hundred men directly interested in the scientific development of Radiology to meet the imperious problems of diagnostic and therapeutic practice. In other similar organizations are a great many others. And outside of all organizations of this character are persons in large number willing and ready to give liberally in support of a real program of scientific research for the purpose of extending the field of applicability of Radiology. There are also many men and women throughout the country philanthropically inclined, who would feel it an honor to contribute in varying degrees commensurate with their capacities. So that the question of funds, while of prime importance, is probably the easiest thing accomplished, provided the members of the Radio-

logical Society give unmistakable evidence of their sincerity in this program of scientific research to which they already stand committed before the world.

Certainly, no body of scientific men ever enjoyed an opportunity like that The Radiological Society of North America now enjoys, of getting for nothing the use of hundreds of thousands of dollars worth of equipment, apparatus, and laboratories, and the willing and intensely interested co-operation of the best scientific minds in the world, for the purpose of giving to humanity the results of collaborated and co-ordinated effort in the science of Radiology. To throw away that opportunity deliberately without a struggle to achieve at least a small part of its possibilities is unthinkable.

No great scientific undertaking has ever been achieved without some personal sacrifice. But the sacrifice necessary in this case is so insignificant compared with the personal benefits which will inevitably come to every man engaging in the science professionally that contributions to the fund cannot be viewed in this light. Money given for this work is an investment guaranteeing definite returns in daily practice, returns which, because of the fact that the funds are to be held in trust, will continue perpetually in ever increasing ratio.

Program—Summer Meeting

FRIDAY MORNING—MAY 19TH

- 9:00—"The Practical Dosage of X-rays"—Albert Bachem, Ph. D., Chicago, Ill.
- 9:30—"Combined Radium and Diathermy"—C. W. Hanford, M. D., Chicago, Ill.
- 10:00—"Treatment of Uterine Fibroids with Slides, Showing Original Appliances"—James M. McCoy, M. D., Vincennes, Ind.
- 10:30—"The Determination of the Intensity of X-rays of High Voltage"—Henry Schmitz, M. D., Chicago, Ill.
- 11:00—"The Inheritability of Spontaneous Cancer in Mice and Its Application to Man"—Maud Syle, M. D., University of Chicago.
- 11:30—"Cancer from the Standpoint of Etiology and Pathology"—L. Loeb, M. D., Washington University, St. Louis, Mo.

FRIDAY AFTERNOON

- 1:30—"Later Effects Upon the Respiratory Tract of the Chemical Gases Used in Warfare"—Gentz Perry, M. D., St. Louis, Mo.
- 2:00—"Gall-bladder Disease"—Robert Arens, M. D., Chicago, Ill.
- 2:30—"Evidence of Regeneration of the Mandible and Maxilla"—T. E. Carmody, M. D., Denver, Colo.
- 3:00—"A study of the Effects of Heavy Radiation on the Pleura and Lungs—A Preliminary Report"—A. F. Tyler, M. D., and J. R. Blackman, M. D., Omaha, Neb.
- 3:30—"An X-ray Demonstration of the Naso-Lacrimal Passageways—Normal and Obstructed"—Howard P. Doub, M. D., Detroit, Mich.
- 4:00—"Radium and Roentgen Rays in the Treatment of Metastatic Testicular Tumors"—Henry H. Bowing, M. D., Rochester, Minn.
- 4:30—"The Surgical Aspect of Cancer"—A. J. Ochsner, M. D., Chicago, Ill.

SATURDAY MORNING—MAY 20TH

- 9:00—"The Use of High Voltages in Metarrhagia and Fibroids"—F. H. Rodenbaugh, M. D., San Francisco, Cal.

- 9:30—"The Effect of X-ray on Cell Division"—Jas. W. Mavor, M. D., Schenectady, N. Y.
- 10:00—"Does Radiation Enhance Post-Operative Recurrence of Cancer of the Breast"—M. J. Sittenfeld, M. D., New York City.
- 10:30—"Studies on the Effect of X-rays on Glandular Activity—
1—"A Critical Review of the Literature."
2—"The Submaxillary and Gastric Glands."
by
Drs. A. C. Ivy, B. H. Orndoff, A. Jacoby and J. E. Whitlow, Chicago. *From the Department of Physiology and Radiology, Loyola University School of Medicine, Chicago.* (With Lantern Slides).
- 11:00—Report of Committee on Research—A. F. Tyler, Chairman.

SATURDAY AFTERNOON

- 1:30—Title to be announced—W. S. Lawrence, M. D., Memphis, Tenn.
- 2:00—"Present Status of Radiation Therapy with Case Reports"—J. Thompson Stevens, M. D., Montclair, N. J.
- 2:30—"An Estimate of the Value of Perirenal Emphysema in Diagnosis"—L. T. LeWald, M. D., New York City.
- 3:00—"Radiotherapy in Carcinoma of the Larynx, with Special Reference to Needling Through the Thyroid Membrane"—Geo. E. Pfahler, M. D., Philadelphia, Pa.
- 3:30—"Protecting Patients from the High Voltage Line"—Albert Soiland, M. D., Los Angeles, Cal.
- 4:00—"Peptic Ulcer"—R. T. Wilson, M. D., Temple, Texas.
- 4:30—"Physical Measurements Associated with the Production of High Voltage X-rays"—Mr. Frank Rieber, San Francisco, Cal.

SATURDAY EVENING

Banquet.....Planters Hotel

Program—American Radium Society

Monday and Tuesday, May 22 and 23, 1922.

Headquarters and Place of Meeting

PLANTERS HOTEL — ST. LOUIS, MISSOURI

MONDAY, MAY 22, 1922

MORNING SESSION

(Begins Promptly at 9:30)

A.—EXECUTIVE SESSION.

B.—SCIENTIFIC SESSION.

- 1 "Lymphosarcoma and Other Glandular Enlargements of the Neck—Their Radiation Treatment."—Edward H. Skinner, M. D., Kansas City.

Discussion to be opened by Albert Soiland, M. D., Los Angeles.

- 2 "Experience with Radium in the Treatment of Bone Tumors."—Joseph C. Bloodgood, M. D., Baltimore.

Discussion to be opened by William S. Stone, M. D., New York. (By invitation).

- 3 "Treatment of Carcinoma of the Esophagus by Radiation."—Walter Mills, M. D., and John Kimbrough, M. D., St. Louis. (By invitation).

Discussion to be opened by Charles F. Bowen, M. D., Columbus, Ohio.

- 4 "Statistics and Technique in the Treatment of Carcinoma of the Rectum by Radiation."—

Harry H. Bowing, M. D., Rochester, Minn.

Discussion to be opened by Douglas Quick, M. D., New York.

- 5 "Technique and Ante-Operative Radiation for Carcinoma of the Breast."—Russell H. Boggs, M. D., Pittsburgh.
- 6 "Statistics and Technique in the Treatment of Carcinoma of the Breast by Radiation, from the standpoint of the Surgeon."—Burton J. Lee, M. D., New York. (By invitation).

Discussion on these two papers to be opened by B. R. Kirkendall, M. D., Columbus, Ohio.

AFTERNOON SESSION

- 7 "Statistics and Technique in the Treatment of Carcinoma of the Uterus and Pelvis with the Combined Use of Radium and X-rays."—Henry Schmitz, M. D., Chicago.
- 8 "Statistics and Technique in the Treatment of Malignant Disease of the Uterus and Pelvis by Moderate Quantities of Radium."—John G. Clark, M. D., Philadelphia.
- 9 "Results of Treatment of Carcinoma of the Cervix, with Statistics and Technique."—Curtis F. Burnam, M. D., Baltimore.
- 10 "Statistics and Technique in the Treatment of Certain Benign Uterine Conditions by Radium."—Leda J. Stacy, M. D., Rochester, Minn.
- 11 "Statistics and Technique in the Treatment of Uterine Fibroids by Radiation."—James A. Corscaden, M. D., New York.

Discussion on this symposium to be opened by James T. Case, M. D., Battle Creek.

- 12 "Radium Therapy in Cancer of the Prostate."—Hermion C. Bumpus, M. D., Rochester, Minn. (By invitation).
- 13 "Statistics and Technique in the Treatment of Carcinoma of the Bladder by Radiation."—Benjamin S. Barringer, M. D., New York.

MONDAY EVENING

ANNUAL DINNER.

Address by the President, George E. Pfahler, M. D., "Protection in Radiology."

TUESDAY, MAY 23, 1922

MORNING SESSION

A.—SHORT EXECUTIVE SESSION.

B.—SCIENTIFIC SESSION.

- 14 "Statistics of the Intra-Oral Group of Carcinomas."—Douglas Quick, M. D., New York.

Discussion to be opened by Rex Duncan, M. D., Los Angeles. (By invitation).

- 15 "The Treatment of Infected Tonsils by Radium."—C. Augustus Simpson, M. D., Washington. (By invitation).

- 16 "Radium Treatment of Nasal Polyps."—H. R. Lyons, M. D., Rochester, Minn.

Discussion to be opened by C. Everett Field, M. D., New York.

- 17 "Statistics and Technique in the Treatment of Malignant Disease of the Antrum by Radium."—D. Crosby Greene, M. D., Boston. (By invitation).

Discussion to be opened by Henry K. Pancoast, M. D., Philadelphia.

- 18 "Statistics and Technique in the Treatment of Malignant Neoplasms of the Larynx."—Douglas Quick, M. D., New York.

Discussion to be opened by John M. Lee, M. D., Rochester, N. Y.

- 19 "Technique in the Application of Radium Needles."—William L. Clark, M. D., Philadelphia.

Discussion to be opened by Charles F. Bowen, M. D., Columbus, Ohio.

AFTERNOON SESSION

- 20 "Statistics and Technique in the Treatment of Malignant Disease of the Skin by Radiation."—Frank E. Simpson, M. D., Chicago.
- 21 "Statistics and Technique in the Treatment of Malignancy of the Skin by Radiation."—Howard Morrow, M. D., and Lawrence R. Taussig, M. D., San Francisco. (By invitation).
- 22 "The Treatment of Superficial Cancer, with Statistics and Technique."—D. T. Quigley, M. D., Omaha.

Discussion on this symposium to be opened by Ralph H. Stevens, M. D., Detroit.

- 23 "Comparative Measurements between Radium and X-rays Concerning Energy Absorbed at Depth."—Harvey R. Gaylord, M. D., and Carl W. Stenstrom, Buffalo. (By invitation).

- 24 "On Ionization Measurements."—Gioacchino Failla, E. E., New York.

Discussion on these two papers to be opened by Charles H. Viol, Ph. D., Pittsburgh.

- 25 "Proposed Collective Investigations of Certain Aspects of the Treatment of Malignant Disease."—Robert B. Greenough, M. D., Boston. (By invitation).

- 26 "The Present Field for the Use of Radium and the X-ray in the Treatment of Malignant Neoplastic Disease."—William S. Stone, M. D., New York. (By invitation).

- 27 "The Biological Effects of Radio-Active Substances and X-rays on Cell and Tissue Structures."—Leo Loeb, M. D., St. Louis. (By invitation).

- 28 "Two Important Points Regarding Cancer Immunity from the Radium Therapist's Standpoint."—Carroll Chase, M. D., New York.

Discussion on these two papers to be opened by Isaac Levin, M. D., New York.

DEMONSTRATIONS OF APPARATUS, APPLICATORS AND TECHNIQUE

- 1—Carroll Chase, M. D., New York: Illustrating new chart for use in radium therapy.
- 2—Dr. Carl W. Stenstrom, Buffalo: A new device for retubing radium emanation.
- 3—Albert Soiland, M. D., Los Angeles: Lantern slide demonstration; the protection of our operators from unnecessary radium radiation.
- 4—Sinclair Tousey, M. D., New York: Estimation of the safe dose of different radium preparations by photographic measurements.
- 5—Henry K. Pancoast, M. D., Philadelphia: A radium needle holder for laryngeal growths.

Military Roentgenology

DURING the American Medical Association week (probably immediately following the close of the session of the American Radium Society) the Military Roentgenologists of the United States will entertain at a "stag". Definite date will be announced.

Dr. W. H. Stewart, president of that organization, has conferred on our own Dr. Ernst the job of making necessary arrangements, and from present indications this will be the big social event of the week. The affair will be strictly

informal and will typify all phases of army life, both at home and abroad, Paris included.

Every Military Roentgenologist is "eligible" though at the moment no information is imparted as to the qualifications implied.

Dr. William Duane

MEMBERS of the Radiological Society will be happy in the distinction accorded Dr. William Duane of Harvard, who was quite recently awarded the John Scott medal and certificate, with premium of \$800.00, by the Board of Directors of City Trusts of Philadelphia for his researches in radioactivity and x-rays.

The award is made annually for scientific achievement in accordance with the terms of a bequest over a century ago by John Scott. Last year the winner was Mme. Curie.

Professor Duane has played a large part in the development of methods of using radium and x-rays in the treatment of cancer. He was the discoverer of a means of securing a new type of very penetrating x-rays for this purpose.

Dr. Preston M. Hickey

INFORMATION has just been received that Dr. Preston M. Hickey, of Detroit, has been chosen as successor to the late Dr. James G. Van Zwaluwenburg at Ann Arbor.

Felicitations are extended to both Ann Arbor and Dr. Hickey, to the University because of its rare choice, and to Dr. Hickey because of the wonderful opportunities such a connection assures. As head of the Department of Roentgenology at Ann Arbor, Dr. Hickey, who is now in Europe, will have excellent opportunity for applying the wealth of native ability for which he has long been recognized by his colleagues.

Detroit Radiological Society

The Detroit Radium and X-Ray Society has just been organized in Detroit, Mich. The officers for the ensuing year are as follows:

President. Dr. P. M. Hickey
Vice President. Dr. R. E. Loucks
Secretary-Treasurer. Dr. J. H. Dempster

Persuasive Diagnosis

THE subtleties of thought and sophistication of presumptive knowledge are factors that operate in deductive reasoning, and, since the practice of medicine is so manifestly deductive, it at once becomes quite apparent that different opinions might be rendered by different persons, and these opinions be based upon the same findings.

It is, indeed, a fortunate situation that roentgenology, by means of the radiogram or the fluoroscope, appeals to that most stable special sense of sight. It is with a feeling of gratification that in a given case, there is probably more unanimity of opinion among roentgenologists than among most any other group of medical specialists. Visualized findings are so much more reliable and usually more capable of interpretation than auscultatory, percussive or palpatory findings. Because of this quality, undue enthusiasm on the part of some roentgenologists tends to discredit a valuable aid; on the other hand, conclusive reliance should not be placed on the roentgen ray findings alone.

As medical men, it is our privilege to get some data, such as anamnesis, clinical findings, and laboratory findings to assist us in attaining a more scientific diagnosis; of course, the findings and determinations should be given in roentgenological terms only; and these findings should be evaluated according to their certitude; if this cannot be done and several pathological processes are possible, they might all

be mentioned in such rotation as to indicate their probability.

In so doing the profoundest respect, consideration, and credit should be given to other specialists and to the doctor referring the case. This must constantly be borne in mind to avoid any hostility; due credence should be given where it belongs and when this is universally practiced, co-operation rather than competition will be the result. In correlating the roentgen and other findings, it is very tempting to make definite conclusions on findings other than roentgenological ones.

This practice is to be condemned if used unqualifiedly. It is this very thing that casts suspicion on meritorious roentgen work. *This method reads a diagnosis into the plate and fluoroscopic examinations, rather than reading a diagnosis out of the plate and fluoroscopic examinations.*

In other words, it is the border-line or vague case, that demands a frank admission of limitation; and it is in just such cases that the roentgenologist will have a surging tendency to make his findings conform to a prior tentative diagnosis. It can readily be seen, if one is justly indecisive, how the clinician or surgeon with the most sincere and honest intentions can persuade a roentgenologist to make a decision which is quite arbitrary. In so doing, misleading conclusions are made and if, in this instance, surgical verification is made, one is credited with a spectacular, although unjustifiable, diagnosis; however, it is more often the case, that the operative findings do not support the so-called roentgen findings, thereby discrediting x-ray work in general. It is a peculiar psychological fact that one error more than offsets the value of numerous correct diagnoses. If this is true, would it not be advisable to adopt and use such methods and information as are *definitive*, and, if such do not exist, then acknowledge the inability to reach a definite conclusion.

Instead of bluffing or making a questionable positive diagnosis, it should be considered better to make a negative diagnosis. The phrase, "I don't know," will avoid many castigations and is used by the really great man or the ignorant, and when used by the former does not cast a blemish on his escutcheon.

It should be the privilege of the roentgenologist to suggest, advise, and to expect continued or repeated observation of a patient, as in some cases it may require a lapse of time to produce x-ray manifestations, for instance, in osteomyelitis; in other cases, the permanency of an x-ray manifestation may be in doubt, for instance, it may be necessary to decide between a gastric spasm (intrinsic or extrinsic) and a gastric neoplasm. It can readily be seen that this is quite vital.

In conclusion, for the promotion of confidence, let's be sure we are right, then go ahead. If in doubt, say so, and when we don't know, it is no disgrace to acknowledge it.

M. J. HUBENY.

Proposed Questionnaire to Nursing Profession

THE Radiological Society of North America has appointed a committee to study the relationship between roentgenologists and technicians, and has voted to co-operate with the American Association of Radiological Technicians. A Board of five has been appointed for the examination, certification, and control of ethical x-ray technicians; and for the recognition and endorsement of qualified laboratories as training schools, both physicians' private laboratories and in hospitals.

Among the proposed requirements to be laid down by the Board are the following: Candidates must agree to work only under direct medical or dental supervision; they must agree not to give out written or oral diagnoses; they shall be twenty-one years old; they shall have the equivalent of a high school education and that of a registered trained

nurse. By the equivalent of a trained nurse is meant those x-ray technicians, male and female, who have already been brought into the work by the medical profession and who are trained, experienced, and committed to this line of work.

Since the nurse and the physician are the only ones legally and professionally qualified in all states to handle the sick under all circumstances, since the nurse is trained in the etiquette of a physician's office and is not handicapped in handling female patients in all stages of exposure as is the male technician, since the trained nurse in many ways can fit into the routine of both a doctor's office and a hospital, where she has a definite standing—for these and other reasons that may occur to you, we are preparing to commit ourselves to the stand of accepting only the trained nurse as a candidate for certification for the future. Before doing this, however, we want to sound out the attitude of the nursing profession, and we are, therefore, asking you to consider the accompanying questionnaire carefully and give it your earliest attention, as this matter must come up for the Executive Committee meeting of The Radiological Society at St. Louis in May, 1922.

X-ray technical work is a combination of the following, in order of importance: (1) Mechanical aptitude with ability to learn the use of electrical apparatus on a precision basis, the elements of photography and developing; (2) Nursing training and etiquette; (3) General executive ability, since many laboratories require several technicians and need a chief technician.

To an apprentice with no x-ray training we favor the following: *No charge* for training, but *no salary* for the first three months; a moderate salary to cover living expenses for the next three months or more until the course is finished, depending on the ability and aptitude shown.

It is hoped that the nursing profession will not set its salary requirements so high, either in the state of apprenticeship or as licensed technicians, that its services will be prohibitive. It is obvious that while this is a specialty, it will probably not command as large a salary per month as private bedside nursing. If nurses demand salaries in excess of the ordinary doctor's ability to pay, the medical profession will have to fall back on male technicians, undergraduate or sub-nurses, and laymen who have had not proper training in the care of the sick or in professional ethics.

The trained nurse technician would be in a responsible position, would have to learn to do many things well, and the future would seem to offer continued demand for her services. X-ray work is all-the-year-round work and may appeal to nurses for the following reasons:

- 1—A change from routine nursing.
- 2—A seven to eight hour day, no Sunday or holiday work except an occasional emergency; no night work.
- 3—Lighter work for the physically handicapped, which would enable a nurse to continue active for a longer time than is possible in private nursing.
- 4—It is in the nature of a specialty requiring study and continual progress, and should bring adequate reward financially to those of superior ability.

Kindly fill out the enclosed questionnaire and return at your earliest convenience. In addition will each radiologist have his technicians answer the questions either singly or in a group. This will greatly aid the committee.

Very truly yours,

BYRON C. DARLING, M. D.,

Secretary, Board for the Examination and Control of
X-ray Technicians, 104 East 40th St., New York
City.

QUESTIONNAIRE

- 1 (a) Do you agree with the policy expressed in the accompanying letter?
 Why?
 If not, in what particulars do you disagree?.....
- (b) What constructive suggestions have you to make?.....
- (c) Would you advocate the general use in doctors' offices and hospitals of a male technician?.....
 If not, what reasons have you for your position?.....
- 2 (a) Do you think that nurses with mechanical aptitude would favor x-ray work as a desirable kind of post-graduate work?.....
- (b) Would they be willing to serve a probationship and an apprenticeship without pay?.....
 (1) If so, for how long?.....
 (The shortest course should be at least six months.)
 (2) If not, what terms would you consider fair in this period of instruction?.....
 (Such a pupil would be of little technical help to the laboratory for the first three months.)
- 3 What would be considered a fair salary for a nurse doing x-ray work in a doctor's office or institution from nine to five-thirty daily, one-half day off a week, no work on Sunday or holidays, provided she had had one and one-half years experience and had been certified by the Board?.....
 (At the present time the average salary in large cities in the east is from \$150 to \$175 a month without maintenance, or \$100 to \$125 with maintenance. Outside of large cities or in the west the average is possibly \$50 a month more.)
 (a) Without maintenance?.....
 (b) With maintenance?.....
- 4 Additional remarks or suggestions:.....

NEW EQUIPMENT

A New Wappler Composite X-Ray Unit

A NEW apparatus has been developed in the laboratories of the Wappler Electric Co., which represents a further step in advance in x-ray apparatus useful for a great variety of purposes.

Reference is had to the Wappler Composite X-ray Unit. It consists of a radiographic and fluoroscopic transformer equipped with insulated high tension masts and a high tension switch so that merely by turning a hand wheel the current can be directed either to the fluoroscopic apparatus beneath the table or to the radiographic tube supported in a counterbalanced tube shield located above the platform of the table. The control of the transformer is by means of a small portable control stand containing control switches, meters, and an auto transformer equipped with a special stabilizing feature insuring independent control of the tube current (ma.) and the penetration (back up) of the rays. This control stand can be moved about and placed so that it is convenient either when making fluoroscopic examinations or when making radiographic exposures.

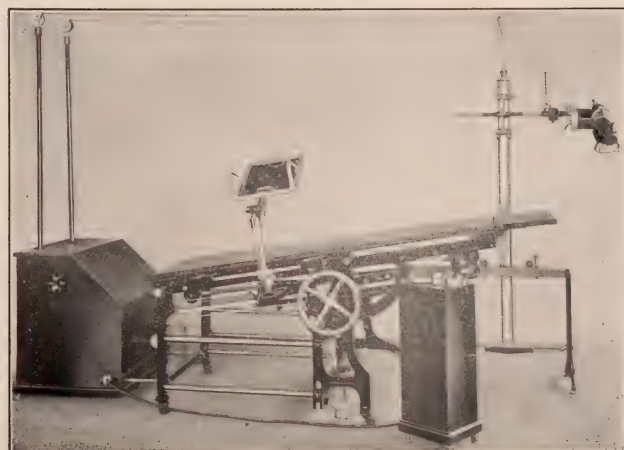
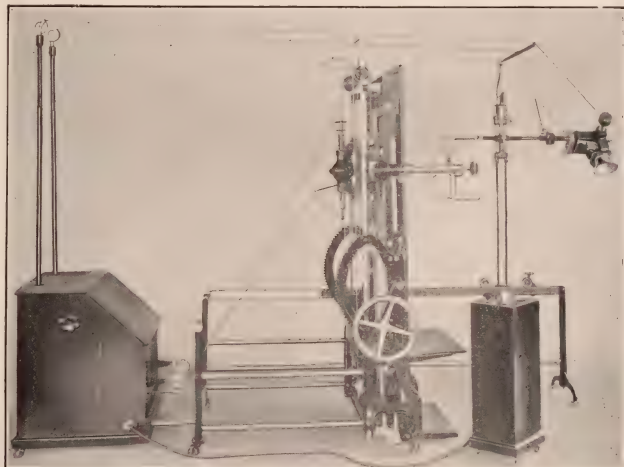
The table itself is mechanically very much improved. The improvements are brought into prominence in the form of the new tilting device for the table and the improved screen and shutter holder. The table top is of wood and can be tilted by turning a wheel, gradually and surely changing the position of the table from horizontal or vertical or any desired intermediate angle. Additional flexibility can be secured by releasing a pair of stops which stop the table in the horizontal position, that is, so that the patient's head is considerably lower than the abdomen, and in this way the very useful Trendelenburg position is obtained. The table top is firmly held in the desired position by a secure locking device so that accidents due to unexpected tilting of the table are absolutely impossible.

The shutter device has been materially improved by the construction of a metallic funnel through which all secondary and side radiation is effectively held back. The gray appearance of the fluoroscopic image which very often makes the fluoroscopic examination of heavy patients difficult or impossible is effectively checked. Examination of

this shutter reveals that a decidedly better and clearer fluoroscopic image can be obtained with this improved shutter and shield. The screen itself is absolutely flexible. It can be placed in any desired position and the area covered by the fluoroscopic tube and shield is large enough that the entire trunk of a patient can be examined fluoroscopi-

cally without shifting the patient.

For radiographic work the screen arm can be removed. After changing the high tension switch the radiographic tube can be used above the table and all radiographic examinations feasible with the thirty ma. radiator type Coolidge tube can be made accurately and securely with a minimum loss of time



involved in changing from one position to the other or from the fluoroscopic to the radiographic setting. The floor space required for this unit is ten and one-half by four feet. If the unit is required only for fluoroscopic work it can be connected to an existing house line, but if the thirty ma. radiographic tube is to be used for radiographic work a line with a carrying capacity of about three k.w. must be provided.

The x-rays, with full justification, have become known as a positive means for diagnosis and their successful application depends to a very large extent on the design and development of apparatus applicable to the great variety of examinations which the medical practitioner is required to make. Thus, for establishing accurate and correct diagnosis a number of different methods of applying the x-rays must be feasible. As an example, for the examination of the visceral organs, especially with regard to their position and mobility, there is required a fluoroscopic device which enables one to place the patient in various positions, from vertical to horizontal, and even in the Trendelenburg position. A change of position from erect to horizontal may reveal the extent of mobility of the viscera, but for observing smaller lesions *in extenso* it is often advantageous to use some method which gives better details and permanent records for leisurely study.

The progress made in transformer design, in tubes and in intensifying screens and films, etc., makes it possible (with equipment which occupies comparatively small floor space, is easy to operate and relatively inexpensive) to make practically all the tests and examinations which are of importance to the diagnostician. In addition to that, the working out of adequate examining apparatus, such as tilt tables which are safe to operate and easy to manipulate, has greatly facilitated the application of the x-rays.

This unit has been found very useful in the office of internal medical men, surgeons or orthopedists and general practitioners, chiefly because of its almost universal applicability and because of its ease of operation.

Waite and Bartlett Mobile Radiographic Unit and 20 Inch Interrupterless Machine

A MOBILE radiographic unit, similar to the one made by the same company for the United States Army, has been recently brought out by Waite and Bartlett Manufacturing Company. This unit is twenty-four inches wide, twenty inches deep, twenty-eight inches high, and is

mounted on roller bearing wheels ten inches in diameter.

In the bottom of the cabinet is a thirty-five foot reel so that it can be easily connected with the service. The tube stand is made in two parts, and instead of the usual counter-weight as a counter-balance, a special spring is mounted on the top of the standard. The tube carrier part is arranged so that it automatically locks on the stand without requiring any thought on the part of the operator.

There is a milliammeter, volt meter, auto transformer with two volt steps, a double pole overload circuit breaker, a hand time switch with a stereoscopic reset, and arranged so that in addition to pressing on the push button, there is another contractor that the operator has to hold. This is for safety, so that one not acquainted with the apparatus could not put it into operation by simply pressing the push button.

Another piece of apparatus being introduced by the same company is a twenty inch interrupterless machine, which has several novel features. First, the transformer is made up in two units, having both terminals developed. This is in contra-distinction to the Waite and Bartlett ten inch machine, which has two terminals, but each transformer has only one terminal developed. The advantage of having both terminals developed in the twenty inch machine, is that each transformer represents practically a ten-inch transformer. Then the rectifying shaft has four cross arms, each pair of cross arms commutating the high tension current from each transformer. After this current has been rectified, the two ten inch circuits are connected in series and grounded. This enables the Waite and Bartlett Company to place the milliammeter on the low tension switchboard and use the regular direct current milliammeter.

The theory advanced in support of this method of construction is that it enables the operator to make accurate readings and does away with the difficulties encountered when the meter is cut in on the high tension circuit.

The cabinet housing this machine is only thirty-two inches wide, five feet eight inches long, and four feet six inches high. This machine is conspicuously quiet in its operation.

High Tension Electro-Surgical Scalpel

A NEW electro-surgical instrument that will be of great interest to radiologists and surgeons has been perfected by the High Tension Transformer and Equipment Company of Hoboken, N. J. This instrument has been named the Electro-Scalpel. It is

particularly valuable in operating upon cancerous growths and in abdominal work. It makes a clean incision such as would be made by a sharp scalpel, or, by simple adjustment of the current control, a cauterant effect may be produced. No edge is needed on the blade, as the cutting is not done by pressure. The tissues are divided ahead of the progress of the blade by a special, rapidly oscillating current of delicately attuned frequency, but of comparatively low voltage. In fact, the voltage is not great enough to puncture a piece of paper against a grounded plate.

Many laboratory tests and limited clinical use in abdominal operations and tumors upon other parts of the body have proved that the Electro-Scalpel is reliable under all circumstances. The incision made is clean, with no visible sloughing of the marginal tissue, and, when it is desired, the instrument may be adjusted to produce coagulation to any desired extent. Another new feature of this instrument is that the blade does not become hot and, instantly upon turning off the current, it may be applied to any part of the body without any sensation of heat.

The range of usefulness of this instrument in surgical work seems to be unlimited, as it may be regulated to all types of operations, from the most delicate, such as on or around the eye, to heavy tumor work, and the blade may be designed to suit any requirement.

The nature of the current used is said to be new to electro-surgical instruments and its application opens a field which is not at present covered by any other appliance.

The Electro-Scalpel will be demonstrated at the mid-year meeting of the Radiological Society in St. Louis, May 19th to 22nd.

High Tension Intermediate X-Ray Unit

THE following letter just received from Mr. Casper S. Spangler of The High Tension Transformer and Equipment Company of Hoboken, New Jersey, alludes to a discussion on the above apparatus, which appeared in the April issue of the Journal of Radiology. It is self explanatory.

"We are very much displeased with the gross misrepresentation of our Intermediate X-ray Unit which you printed in the Journal of Radiology, April issue, page 149.

"The statements made in the article are incorrect and entirely misleading. The author of the article has apparently paid no attention to the information we furnished you with our letter of February 18th.

"Referring to the article as it appeared in the Journal, beginning with the second paragraph the statement is repeatedly made that rectification is accomplished by means of the Rotary Wave Selector in the primary circuit. It is in the secondary circuit of the transformer although it is not placed across the secondary terminals. Throughout the article reference is made to rectification in the primary—the author going so far as to mention 220 volts as the potential at which rectification is accomplished. This is not true. Furthermore, inferences and conclusions are drawn in regard to the effect on the wave form, which, while they might invite discussion if rectification were actually made in the primary, have no application in the true case. The author shows no understanding of the principle of rectification applied in this machine, and we are at a loss to understand why such statements have been printed when correct information was at hand for his reference.

"Already we have received a letter from a prominent physicist calling our attention to 'the grossly incorrect statements on page 149 of the Journal of Radiology, April issue.' Our correspondent further says, 'I hope you will call the editor's attention to these errors and have him correct them in the next issue.'

"We appreciate the letter quoted and it is hardly necessary for us to remind you that the majority of readers have not been previously as well informed as this scientist whose business it is to know this subject.

"Will you please refer to our write-up, mailed with our letter of February 18th, as well as to the enclosed booklet, and correct in your next issue the entirely erroneous impression that has been created?"

The following are the essential excerpts from the statement to which reference is made:

"One of the distinctive features of the Intermediate Unit is the simplified method of rectification by means of the new rotary wave selector. It replaces the usual large mica discs or arms with a small moving member driven by a one-thirtieth horse power synchronous motor, which is practically noiseless.

"Because of the electrical design of the Intermediate the rectifying device is never called upon to withstand the total potential of the transformer, because, while it is a part of the secondary circuit, it is not placed across the secondary terminals. It is made a part of the transformer itself. This accounts for its very small size and makes it possible to deliver a uni-directional high tension current directly from the sec-

ondary terminals of the transformer to the tube. This is a feature in rectification that heretofore has been considered impossible.

"In therapy this rectifier is especially valuable in that the soft or long rays generated by the lower parts of the wave are eliminated. * * *

The Journal is glad to make this correction. It would be very grateful, however, if the High Tension Company would give it for publication, a detailed and specific statement of its method of construction, method of rectification, etc. It is not the policy of the Journal to close the door on any development of apparatus, but rather to kick it open and keep it open.

New Acme Tube Stand

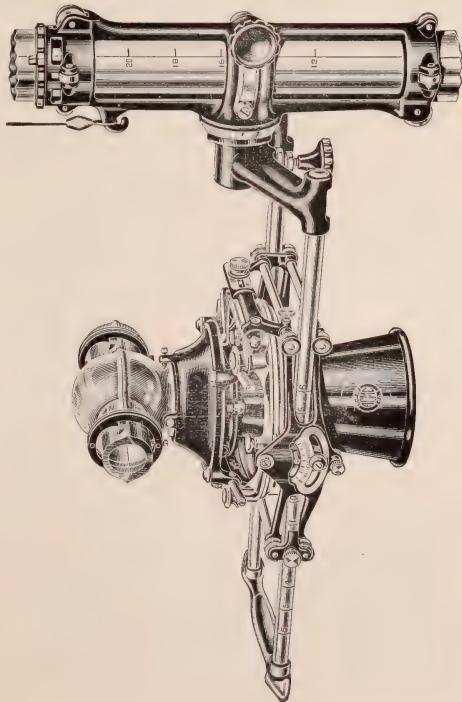
THE introduction of the stereoscopic movement of the Acme No. 1 Radiographic and Stereoscopic Tube Stand marks the advent of an improved method of stereoscopy.

Tube stands as now constructed are arranged to move the focal spot of the x-ray tube two and one-half inches between exposures, regardless of the distance between the target of the x-ray tube and the plate or film. The stereoscope reproduces optically the conditions under which the radiographs were

taken. Radiographs made in accordance with the present day technique cannot be correctly viewed in present day stereoscopes. The technique now calls for most stereoscopic work to be done at from thirty inches to thirty-six inches distance. No stereoscope is now made in which the distance from the center of the mirrors to the face of the box exceeds twenty-four inches. In order to reproduce the conditions, however, this distance must be from thirty inches to thirty-six inches.

The method of stereoscopy embodied in the No. 1 Acme Tube Stand bridges this gap. The optical principles underlying stereoscopic work have been thoroughly analyzed and applied.

The method consists in setting the viewing boxes of the stereoscope at a fixed distance and then calculating the various shifts which the tube stand head will make at various distances between target and film in order that the line of the central beam of x-rays will always coincide with the line of vision as reproduced in the stereoscope boxes at this fixed distance. In other words, the stereoscopic shift mechanism has been so constructed that although the exposures were made at thirty-six inches the tube shift is such that a practically true stereoscopic image is obtained at



the "fixed" viewing distance of twenty-four inches. In that way distortion is cut to a minimum and an essentially true stereoscopic image obtained with the standard stereoscope. All of the advantages of long distance between target and film are secured without the loss of a true stereoscopic image when viewed in a standard stereoscope.

This increase in flexibility and utility has entailed no sacrifice in simplicity. The setting of two stops in accordance with the target to film distance makes all necessary adjustments for the making of a set of exposures.

AIR CONTROL FOR VERTICAL STEREOSCOPY

The Air Control for Vertical Stereoscopy for the No. 1 Acme Radiographic and Stereoscopic Tube Stand is another achievement of Acme Engineers. The need of a device of this nature has been recognized but never really filled. The Acme Stand, however, was designed with this end in view. The air control is mounted directly on the tube head and can be instantly thrown into and out of engagement. It is easily set and operated and gradually checks the descent of the tube head so that there is no jarring, the head moving down noiselessly and coming to rest without a sign of vibration.

Victor All-Metal Developing Unit

A MUCH needed dark room fixture has been added to the Victor line in the shape of an all-metal developing tank—a tank constructed of iron and heavily enameled. Such a tank will not, of course, absorb the chemical solutions and can be kept immaculately clean and sweet smelling without difficulty.

The accompanying illustration shows the Victor tank installed. The solution tanks are interchangeable and are held in position by a ledge on the master tank. There is ample room, it will be observed, between the solution tanks

for suspending film hangers. A constant flow of water in the master tank controls the temperature of the solution in the developing and fixing baths through a thermostatic mixing valve set into the water line. By setting the thermostat at the degree of temperature desired, the flow of hot and cold water is regulated by the mixing valve, and if, for any reason, the supply of hot or cold water fails, the mixing valve mechanism cuts off the other supply so quickly that less than one degree change in the temperature level of the tank occurs.

The tank is sold under a guarantee against chipping, cracking or checking.

The Improved Patterson Intensifying Screen

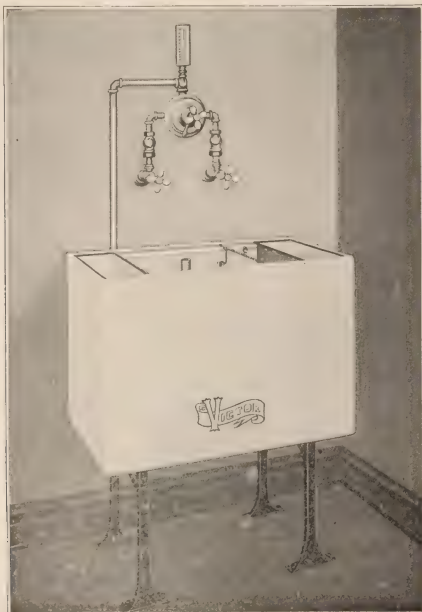
MEDICAL radiologists will doubtless be interested in knowing that The Patterson Screen Company of Towanda, Penn., has achieved another development in the manufacture of intensifying screens.

The development has to do with the "Patterson Cleanable" screen put on the market in September of last year. It will be remembered that while the "Patterson Cleanable" screen as first presented produced excellent negatives, it was slower than the older or unprotected screen. As the Journal is informed, a new process has been discovered whereby certain protective features are worked into the virgin chemical, making it not only cleanable, but practically impervious to dirt, and at the same time have a speed factor equal to that of ordinary screens. The new screen is thin and pliable, has sufficient strength to insure reasonable longevity, dust, ashes or floor dirt will not adhere to its surface, and smear marks such as pencil, crayon or similar substances can be washed off without damaging the screen.

To some extent all screens may be cleaned, even the unprotected ones. But it does not necessarily follow that washing removes all the dirt. A screen can, too, be protected to a certain degree by the use of a transparent celluloid covering, but the screen may get dirty before or during the covering process or dirt may work between the celluloid covering and the screen, imbedding itself in the fluorescent emulsion. There are some objections, however, to the celluloid process, chief among which are that the celluloid covering absorbs considerable of the actinic light given off by the screen, and the celluloid scratches readily and is subject to seasoning and warping processes.

As stated, The Patterson Company obviates these disadvantages by embodying the protective qualities of its new screen in the chemical from which the screen is made.

The Patterson Company has been guided in its exploratory work by the observations made by Prof. Shearer of Cornell University, in France during the time he had charge of this part of the military service.



ABSTRACTS and REVIEWS

IN a letter to the editor of the Journal, Dr. N. E. Dorsey criticizes a statement originally made by Dr. L. C. Donnelly in his paper on "Ultra Violet Ray Therapy, an abstract of which appeared on page fifteen of the March issue of the Journal. To quote Dr. Dorsey:

"The gist of the matter will be found near the end of the second paragraph, where it is said that 'the red blood cells absorb and conduct the rays to different parts of the body.' (The italics are mine). This implies that the light is soaked up by the cells, somewhat as water is soaked up by a sponge, and is then transported by the motion of the cell as the water is transported by the motion of the sponge. Such an idea is totally wrong. Light, x-rays, gamma-rays, all consist of wave motion in a medium; they can be no more absorbed in something and transported by it, than a water wave can be bottled and carried. When these waves encounter material bodies, they may set up motions in them, may even tear them to pieces, and in so doing these waves expend their energy, are used up; to the extent to which they produce such effects the waves cease to exist as such. It is this spending of the wave, the using up of its energy in the production of changes in the material through which it is passing, that is described technically as the absorption of the wave by the material. When the wave is absorbed it ceases to exist, the energy that it carried has been converted into other forms. The absorption of the rays by the blood cells may result in changes in the chemical structure of the cells; and these modified cells may be carried to other parts of the body, but the ultra violet rays are not carried."

Roentgen Ray Intoxication. Unit Dose Over Thorax Negative—Over Abdomen Lethal. Epithelium of Small Intestine Sensitive to X-rays. S. L. Warren and G. H. Whipple. M. D. *From Hooper Foundation for Medical Research, San Francisco.* J. Exper. Med., Feb., 1922, p. 187.

A STUDY of non-specific intoxications was being carried on at the Hooper Foundation at the time this paper was written and the work here recorded forms a part of that study.

This particular study is an investigation of the systemic intoxication which develops after exposure to large doses

of hard roentgen rays. Normal dogs were used throughout these experiments, rabbits not being considered favorable animals for this study.

The fundamental factor in the systemic intoxication which develops after exposure to x-rays was found from these experiments to be a primary injury to the epithelium of the small intestine. The stomach and colon were found more resistant than the small intestine. The factors of red bone marrow, lymphatic tissue, and circulatory blood were ruled out by this study, as were also the liver, pancreas and adrenals. A very interesting fact noted is that even with all the epithelium destroyed many clusters of lymphocytes remained, but it is remarked that lymphocytes in different parts of the body may have varying susceptibilities to radiation.

The conclusions reached by the authors were as follows:

Roentgen radiation of the thorax (abdomen shielded) in dogs, even with large doses (up to five hundred and twelve milliamperes minutes) gives no clinical evidence of intoxication. There may be a transient leucopenia and a slight rise in urinary nitrogen.

Roentgen radiation of the abdomen (thorax shielded) in dogs, with a dose of three hundred and fifty milliamperes minutes, will almost certainly cause a fatal intoxication. Smaller doses may be survived, but usually with signs of gastro-intestinal intoxication.

This lethal intoxication, due to abdominal radiation, presents a remarkably uniform clinical and anatomical picture. There is a latent period of from twenty-four to thirty-six hours during which the dog is perfectly normal clinically. The second day usually shows the beginning of diarrhea and perhaps some vomitus. The third and fourth days show progressive intoxication with increasing vomiting and bloody diarrhea until the dog becomes stuporous. Death is almost always on the fourth day.

Anatomically the only lesions of significance are to be found in the small intestine. The epithelium of the crypts and villi show more or less complete necrosis, and this condition may involve almost all of the small intestine. The epithelium may vanish completely except for a few cells here and there which have escaped and are often found in mitosis, probably an effort at repair and regeneration.

The writers were forced to the conclusion that this remarkable injury of the epithelium of the small intestine is responsible for the various abnormal reactions and final lethal intoxication which follows a unit dose of roentgen radiation over the abdomen of a normal dog. This sensitiveness of the intestinal epithelium to x-rays is not appreciated and should be given proper consideration in clinical work.

Roentgen Ray Intoxication. A Study of the Sequence of Clinical, Anatomical, and Histological Changes Following a Unit Dose of X-rays. S. L. Warren and G. H. Whipple. M. D. *From the Hooper Foundation for Medical Research, San Francisco.* J. Exper. Med. Feb., 1922, p. 203.

THE conviction reached by the study abstracted above, namely, that the initial injury of the epithelium of the small intestine is responsible for the severe clinical reaction and lethal intoxication following exposure to the roentgen ray, was deepened by further experimentation with normal dogs exposed under the same conditions as before. In this series the reactions were carefully studied, the histological and gross changes from day to day being recorded. Controls were used throughout. Authors' conclusions follow:

Roentgen radiation in lethal dosage, given over the abdomen of a normal dog, is followed by a physiological reaction of remarkable uniformity.

The first twenty-four hour period following exposure is negative clinically and anatomically, but histologically we see frank changes in the bone marrow, spleen, lymph glands and ovaries. There are definite nuclear changes with degeneration in the crypt epithelium of the small intestine.

The second twenty-four hour period shows a slight clinical disturbance of gastro-intestinal nature (vomitus and diarrhoea). The mucosa of the small intestine shows scattered ecchymoses, but the histology of the small intestine is important. The necrosis of the crypt epithelium may be almost complete, while the epithelium of the villi remains practically intact. There is a little edema and invasion of wandering cells.

The third twenty-four hour period shows increasing clinical disturbance with vomiting and bloody diarrhea. Anatomically the small intestine from

the edge of the pylorus to the rim of the ileocecal valve looks raw, red and inflamed. The crypt and the villous epithelium have in large part vanished, leaving a collapsed framework of the mucosa showing a little edema and invasion of wandering cells.

The fourth day marks the peak of the intoxication, and death usually follows at this time, preceded by coma. Anatomically and histologically the picture is like that of the third day. There is more evidence of mitosis and efforts at repair on the part of the intestinal epithelium. It is thought that this reaction may be due to absorption of toxic substances and invasion of bacteria from the lumen of the injured intestine, though the writers believe there are other possibilities and these are to be made the object of further study.

The stomach is not concerned in this reaction, but the colon may show evidence of a slight injury. The colon is evidently much more resistant than is the small intestine.

The authors believe the evidence is conclusive that the injury done the epithelium of the small intestine is wholly responsible for the stormy clinical picture and fatal intoxication.

Roentgen Ray Intoxication. Speed of Autolysis of Various Body Tissues After Lethal X-ray Exposures. The remarkable Disturbance in the Epithelium of the Small Intestine. S. L. Warren and G. H. Whipple, M. D. *From the Hooper Foundation of Medical Research, San Francisco.* J. Exper. Med., Feb., 1922, p. 213.

IT is specifically stated that the study of reactions of ferments in "dead or dying cells cut off from circulatory influences" may or may not lead to truly scientific conclusions. With this held in mind the evidence is here submitted to show that cell autolysis in the epithelium of the small intestine is profoundly modified by x-ray exposure.

This study was carried out on sections of the organs of dogs used in the preceding study above. Controls were used and to prevent bias and eliminate mistakes almost six hundred slides were studied as "unknowns" and not only that but were reviewed three times.

Fibroblasts, mature connective tissue cells, endothelial cells and macrophages, muscle tissue and certain white blood cells were not much, if at all, disturbed by the exposure. Some of these cells are generally supposed to be poor in ferments, but not all of them. The clinical symptoms always reach a crisis on the fourth day, and if this period is survived the dog usually recovers.

The following summary is given:

Exposures to large doses of x-rays will cause notable increase in the speed of autolysis of the crypt or secretory epithelium of the dog's small intestine. These changes can be demonstrated readily in material obtained from dogs killed, two, twenty-four, forty-eight, seventy-two or ninety-six hours after the initial radiation.

In the radiated dogs the secretory crypt epithelium of the small intestine autolyzes first and the epithelium of the villi last, while the reverse is true in the normal control of the small intestine. These abnormalities of autolysis associated with lethal roentgen ray exposures can be demonstrated for the small intestine over the whole four day period subsequent to radiation.

The colon shows little change and the stomach no demonstrable change in autolysis under like conditions. The kidney, likewise, is negative.

The spleen, lymph glands, liver and pancreas show a moderate increase in speed of autolysis in tissues taken from radiated animals within forty-eight hours of the initial exposure.

What the significance of this disturbance of cell ferments in the intestinal mucosa may be is not known, but these observations strengthen one's confidence in the profound functional disturbance of this important intestinal epithelium—a disturbance which the writers believe is responsible for the clinical abnormalities and fatal intoxication.

Notes on the Clinical Value of Radium in the Management of Uterine Hemorrhage. Some End Results. John Osborn Polack, M. S., M. D., F. A. C. S. Med. Rec., March 25, 1922, p. 493.

RADIUM has an established place in the treatment of uterine hemorrhages, whether from fibroids, myopathic bleeding, or subinvolutions and fibrosis of the uterus. It is also valuable in leucorrhoea resulting from cervical inflammation.

The author holds that operation is at times the only method of procedure, but he believes that it breaks down the individual's resistance to malignancy, hence recurrence and metastases unless all trace of malignancy has been removed. He believes it is only a matter of time until radium will entirely replace surgery in cancer therapy.

The experience here recounted covers a period of six years use of radium element in quantity varying from one hundred to one hundred and fifty milligrams and does not include any deep therapy cases.

Thirty-one cases of myopathic hemorrhage in young girls were treated.

The average dosage was four hundred milligram hours and one application sufficed for cure in all but one case, which required three. That the menses recurred regularly, and that six of these cases are now married and two pregnancies reported is offered in answer to probable criticisms.

He regards operation as the procedure of choice in most myomata and states that the following disadvantages accompany radium: (1) It produces edema and inflammatory reaction and increases toxemia. (2) Trouble may arise from the presence of nodules outside the uterus. (3) Malignant or other complications may escape notice. (4) Radium in sufficient dosage impairs reproduction. (5) It is too slow in action if pressure symptoms require relief. (6) If necrosis is present radium increases it.

But if proper selection is made radium has the following advantages: (1) No operative mortality. (2) No general anesthetic. (3) No post-operative complications. (4) Prompt control of uterine hemorrhage. (5) Menopausal symptoms not so marked. (6) Shrinkage of tumor in sixty-five per cent of intramural cases with absolute cessation of hemorrhage. (7) Should radium fail operation is still possible. Radium is the treatment of choice in all cases of myomata complicated by heart disease, extreme anemia, diabetes and chronic nephritis.

Radiation of fibroids the writer has confined to tumors not larger than a four months pregnancy, growths definitely intramural with no subperitoneal nodules of any considerable size, and to sessile submucous tumors. Of one hundred and six cases treated with two thousand to three thousand milligram hours, only two have needed subsequent operation. In eighty of the others the tumor shrunk to one-half its original size, and in twenty it entirely disappeared.

Radiation has been applied in two hundred and sixty cases of bleeding resulting from sub-involution and fibrosis of the uterus without lateral or posterior parametritis or history of pelvic inflammation. Bleeding has in all cases been checked. The majority of the uteri have been sessile in character and menopausal symptoms have appeared. Several of these cases have been later submitted to operation for correction of the descensus.

IN The American Journal of Public Health, April, 1922, page 320, W. F. Walker of the Detroit Board of Health reports upon a study made on the water of one of Detroit's swimming pools. An attempt was made to sterilize the water by the use of ultra violet

rays and results, according to the bacteriological tests, are interesting.

All contributory factors were taken into consideration in this study and it is felt that the basis for study was kept constantly uniform. In 1916, before the installation of the ultra violet ray sterilizers, the bacterial test (yearly average) showed *B. coli* 350 for each 100 cc. of water. In 1921, after the installation of the sterilizers, all other factors remaining practically the same, the bacterial test showed *B. coli* .75 for each 100 cc. of water.

Mr. Walker states that "sterilization by ultra violet rays of swimming pool water in a recirculation system, properly designed and operated, gives a water in the pool which compares favorably with the government standard for drinking water."

The Pathological Gall-Bladder Roentgenologically Considered. By Arial W. George, M. D. and Ralph D. Leonard, M. D. Cloth, octavo, Publisher, Paul B. Hoeber, 67-69 E. 59th St., New York City. Price, \$10.00 net.

THE actual text of this monograph covers some thirty-seven pages. The atlas, with a brief introductory text printed in English, French, and German, makes up the remaining four-fifths of the book. It contains forty-four full page plates which present one hundred and thirty five x-ray studies, the captions of which, on accompanying pages, are also given in English, French, and German. These plates are reproduced in the negative and are unusually clear, showing the pathology so positively that there is no room left for dispute on these points.

The authors present the problems which have come to them in their study of this subject, approaching these from every angle of difficulty which they have encountered, and striving to elucidate diagnostic methods. This phase of the problem has by no means been solved as yet and the hope is voiced that this publication may stimulate others to do further work.

The chapter on technique gives specific and detailed directions. Special emphasis is laid upon the futility of attempting fluoroscopic diagnosis of these lesions, contrary impressions notwithstanding. The intensifying screen is regarded as indispensable.

About eighteen pages are taken up with expounding interpretation of films. This is dealt with under the heading of direct and indirect evidence. Under the former is discussed the demonstration, classification and differential diagnosis of gall stones. Also under this heading is a section on the visible pathological gall-bladder. The authors re-

gard as very important their discovery that the pathological gall-bladder, even though no stones be present, may cast a shadow, and that when it does cast a shadow pathology is present. This has been adopted as a working hypothesis and experience has proved it to be absolutely reliable. Differential diagnosis of the pathological gall-bladder is given two pages of practical discussion.

Indirect evidence is treated under the heads of deformities, adhesions, organ fixation, spastic changes in the stomach, and changes in the gall ducts.

Statistics are offered, but with a warning as to their well known misleading character at all times.

This is a valuable reference book for the roentgenologist as well as being of interest to other medical men, especially the surgeon. The simple, lucid, practical style in which the valuable subject matter is written, with no wasted words to entangle and weary the hurried reader, might be imitated by many medical writers with profit to their readers at least.

The only criticism offered is that the general make up of the book has added unnecessarily to its expense. The style of print employed makes the book more cumbersome and costly than is practical or than is necessarily consistent with a pleasing appearance.

The Biologic Dosage of X-ray. Francis Carter Wood, M. D., New York City. Med. Rec., March 11, 1922, page 399.

ROENTGEN ray therapy, apparently, is entering upon the phase of exaggerated enthusiasm typical of the history of many therapeutic agents and methods. Absurd claims are being made when a conservative attitude might far better be adopted.

Research at the Crocker Institute has shown that "the rays produced by high voltage are no more potent in killing standard animal tumors than is any other type of x-ray, about five erythema doses being required, no matter what the voltage or the filtration."

The employment of voltages up to 300,000 will offer a distinct advance in effectiveness of method of treatment as soon as x-ray tubes which will run effectively at a voltage of twenty-five thousand or above are built. The technical knowledge required in the successful manipulation of these machines will limit their use to institutions and to highly trained specialists and thereby the theapneus of malignancy will be largely in the hands of only capable men.

The future of radiotherapy depends upon discovery of the death point for malignant tumors. If five erythema

doses are requisite for complete destruction the ultimate conquest of internal cancer is as yet far away.

The writer believes that the recurrence of malignant neoplasms after radiation shows that the effect is largely on the capillaries and mitotic cells and that ultimately such tumors recur from the better nourished peripheral portions where the blood supply sustained the injured tumor cells during radiation. Experiments with animal tumors confirm this opinion.

The dose of the tumor to be treated, the amount which the skin will stand, plus the capacity of the patient to bear a sufficient dosage are factors which should be known in any treatment of an internal malignant tumor.

The usual present method of determining an erythema dose is a cautious cut and try procedure, and though the dosage is finally arrived at, the method is not only time consuming, but every readjustment of machinery results inevitably in slight alterations which make quite a little difference in the output which is not recorded by the milliammeter.

As a basis for standardized procedure the utilization of such a mouse tumor as Crocker Institute No. 180 is advocated, and suggestions are given looking toward a solution of the problem of standardization of radiation methods. Useful data is expected from the investigations of the committee appointed by the American Surgical Association to study the end-results of radiation therapy.

It is remarked that optimism does not cure cancer, neither does criticism of the results of cancer surgery accomplish a cure; publicity, frankness, and co-operation of all concerned, it is hinted, might bring worth while results.

A Case of Extreme Dilation of the Duodenum Due to Chronic Obstruction. R. E. Roberts, M. D., Liverpool. Arch. Radiol. and Electroth., January, 1922, p. 237.

THIS case was diagnosed by the roentgen ray. The patient, a man forty-two years of age, gave a history of abdominal pain and vomiting since early childhood. For a year previous to the roentgen ray examination the patient had had what he called "liver trouble," that is, pain over the liver, loss of appetite, jaundice, flatulence, vomiting and an intractable diarrhea.

The gall-bladder area and the gastrointestinal tract were examined after a barium meal. No gall stones were found, the stomach and large bowel were found normal, but a very much dilated duodenum was found. At operation this was found to be extreme

indeed. Partial stenosis existed at the juncture of the duodeno-jejunal flexure and about two inches below was a hernial orifice in the mesentery of the jejunum through which almost the entire remainder of the small intestine had passed, but there was no other evidence of obstruction of the small bowel.

The Treatment of Primary Carcinoma of the Vagina with Radium. Leda J. Stacy, M. D., Mayo Clinic. Am. J. Roentgenol., January, 1922, p. 48.

THIS paper was written to call the attention of radiologists to the treatment of primary carcinoma of the vagina by means of radium. The writer found only three cases reported in the literature.

Owing to the rich lymphatic supply of the vaginal mucous membrane the course of this disease is very rapid, terminating in from eight to twenty-six months. It early extends to the iliac glands, but rarely to other organs. The symptoms do not differ from those of carcinoma of the cervix.

From July, 1915, to January, 1921, twenty-one cases were treated at the Mayo Clinic. Information has lately been obtained concerning fourteen of these cases. Seven lived for periods varying from seven to twenty-eight months after treatment and the other seven have been living for periods varying from five months to three years and nine months after the last treatment. Detailed accounts of these fourteen cases are given in the original paper.

The writer believes that radium and x-ray offer better chances for cure than surgery and that as the technique improves a larger number of permanent cures may be looked for; also that better results are obtained with less danger of formation of fistula if the initial treatment by radium is heavy and not repeated, x-ray exposures to the abdomen and back, however, being continued.

Roentgen Ray Stimulation of the Pancreas in Experimental Pancreatic Deficiency. William F. Petersen, M. D. and Clarence C. Saelhof, M. D., University of Illinois, College of Medicine. Am. J. M. Sc., March, 1922, p. 391.

IN the original article the reader is referred to a preliminary communication from the same writers, which was published in the Jour. A. M. A., March 12, 1921. The summary of the article referred to is as follows: "(1) The roentgen ray in proper dosage has the property of stimulating cellular metabolism. (2) When organs are selectively stimulated by the roentgen rays therapeutic results can be

achieved either by direct stimulation of an external secretion (the kidney) or of an internal secretion (the pancreas in diabetes). (3) A second method of possibly influencing remote pathologic lesions lies in the mobilization of antibodies, enzymes, and thromboplastic substances following selective organ stimulation. The effects on tuberculosis (irradiation of the spleen), on hemophilia and purpura (irradiation of the spleen), and some of the effects on malignant tissues can possibly be examined from this point of view with profit."

In this preliminary communication, summarized above, two distinct methods of approach were considered. The direct one seeks by stimulation of dys or hypo-functioning organs to attain or restore normal function; examples are found in the treatment of certain types of anuria, hepatic intoxication, amenia, and in endocrine disturbances. The indirect method includes the stimulation of normal organs and the augmentation of serum enzymes, thromboplastic substances, antibodies, etc., thus bringing about therapeutic effects in systemic or local infections.

The investigation of the possible effect which roentgen stimulation of the pancreas might have on the carbohydrate tolerance of partially depancreatized dogs was undertaken in view of the admitted limitations in the treatment of diabetes.

An almost complete pancreatectomy was carried out on one animal, which after recovery was placed upon a constant diet of one hundred grams of protein and fifty grams of carbohydrate.

Upon roentgen exposure the sugar excretion for the day of exposure increased from thirty-four to forty-three grams, then diminished for three days and with the fourth day reached approximately its first level. Both acetone and diacetic acid were absent from the urine after the exposure.

In the second dog one gram of pancreatic tissue was left *in situ* and the same diet as above was given. Upon raying this animal there was likewise a preliminary increase in sugar excretion and then, after three days, complete tolerance. The second exposure gave a typical rise, but not so good a final tolerance.

A third dog was partially depancreatized and given the same diet as the other two with the addition of one hundred and fifty grams of dextrose on the second day. This dog was given two exposures the same day instead of one. No evidence of increase in the amount of sugar excretion appeared, but a definite diminution in the amount of dextrose eliminated was

shown, in spite of an increase in the amount of blood sugar.

Another animal was partially depancreatized and a cutaneous injection of turpentine and olive oil given to produce small sterile ulcers. This experiment showed that the mere increase of sugar elimination when brought about by general protoplasmic stimulation does not bring about an increased tolerance.

Further experimentation proved that irradiation of areas other than those containing the pancreatic rests does not increase the carbohydrate tolerance.

In another experiment it was found that the effect of irradiation of the pancreas did not produce merely a transient increase in carbohydrate tolerance but an increase which lasted at least eight days. With increased dosage depression of function and lowered carbohydrate tolerance was noted.

The writers also draw upon Stephan's report of deep roentgenotherapy over the pancreatic area in two cases of severe diabetes.

Their conclusions from this series of experiments they summarize as follows: "In experimental pancreatic deficiency due to partial pancreatectomy roentgen irradiation of the pancreatic rest may be followed by (a) a transient increase in sugar output, then by (b) an increase in carbohydrate tolerance. This latter may occur without the preliminary increase in sugar excretion. The increased tolerance may be transient or may extend over a period of several weeks after irradiation. (c) The increased tolerance is not due to the preliminary increase in sugar elimination. When increased sugar elimination is brought about by some other irritant (turpentine abscesses) no increase in carbohydrate tolerance is later observed. (d) The effect on the blood sugar varies. (e) When evidences of acidosis exist at the time of the irradiation they may diminish or disappear with the improvement of the sugar tolerance. (f) The effect of irradiation on the pancreas is due to direct stimulation of cellular metabolic processes. (g) This stimulation is merely an example of the Arndt-Schulz observation that cell irritants in small doses stimulate metabolic processes. (h) When the irradiation is used in too large a dose injury to the pancreas function is observed in decreased carbohydrate tolerance. (i) When tissues other than those containing the pancreatic rest are irradiated no effect is observed on the carbohydrate tolerance other than the primary augmentation of the sugar excretion. (j) The titer of the serum diastases, which may be altered by irradiation of the liver, seems to be without influence on the tolerance.

Effect of X-rays on Enzyme Action. R. D. Lawrence, M. B., Ch. B. Aberd., King's College Hospital, London. Arch. Radiol. & Electrol., January, 1922, p. 244.

The literature on this subject is scanty and the results reported are conflicting.

Packard claims that the entire effect of radiation on cells is indirectly due to its influence upon enzyme action. Hunter and Gerhart, studying the effects upon rennin, yeast, pepsin, pantothen and adrenalin, which latter, the writer observes, is not an enzyme, find either no change or such slight change as fell within the bounds of experimental error. Richards working with pepsin on egg albumin and taka-tase on starch found that exposures (not stated) up to four minutes accelerated enzyme action, above five minutes it slightly inhibited enzyme action and at exactly five minutes there was no change noted.

The writer worked with oxalated human plasma from men, with urine in a variety of cases, sheep serum, urine plus horse serum. Radiation was carried out under uniform conditions, the fluid being radiated in a beaker, using a Coolidge tube at nine inches from the anticathode with a five one-half inch gap and unfiltered radiation at two milliamperes in the ordinary.

In no experiment was the diastase found to change after radiation and the conclusion drawn from this series of experiments is that radiation has no effect on enzyme action, as shown by the above method, and therefore the effect, if any, is extremely slight and of no practical importance.

Treatment of Carcinoma of the Thyroid by the Roentgen Rays and Radium. George E. Pfahler, M. D., Philadelphia, Pa., Am. J. Roentgenol., January, 1922, p. 20. The author's experience in treating carcinoma of the thyroid with radium and with the x-rays has extended over a period of eleven years and the results are very gratifying, secured as they were with almost hopelessness.

The histories and treatment are given in ten cases. One of these when last reported from in 1918 was in good health and had been so during the seven years of treatment. Another case, operated on by Dr. Deaver, who stated that remnants of the carcinoma had had to be left in the neck, was treated with x-rays and is still well eight years after treatment. A third case operated on for malignancy, once for bronchogenic cyst and once for carcinoma of the thyroid, was treated and is still

well and free from disease more than three years after discontinuance of treatment. A fourth patient was operated twice for carcinoma in the region of the thyroid. The second time the carcinoma was judged inoperable and was left in place. This case was given x-ray treatment and lived comfortably for about one year, but died two years later from metastases in the spinal column. Two very hopeless cases died, one showed improvement for a year, the other showed none. A seventh case, proven microscopically to be carcinoma of the thyroid, was treated with the x-ray alone and now, nearly three years after treatment, has perfect general health and the hope of a real cure is held out to him. The eighth case treated soon after operation for carcinoma of the thyroid is still well more than two years since operation and post-operative treatment. Still another hopelessly inoperable case was treated first with x-ray and later with radium. He has shown progressive improvement and now, one year and nine months after treatment, carries on his regular duties and hope of complete recovery is held out to him. The last case described had a large tumor, irregular in outline and infiltrated. It was diagnosed as carcinoma, treatment was instituted and two months later all palpable evidence had disappeared and the patient is now, six months since then, apparently well.

Many of these carcinomas were sectioned and upon microscopic examination were pronounced carcinomatous.

The technique is described as follows: "In general I believe that it is advisable to treat these patients through three or more portals of entry, according to the amount and distribution of the disease, with a focal skin distance of thirty centimeters, using a nine inch parallel spark gap, five ma. of current, six mm. of filter, with an exposure of twenty minutes, to be repeated over each area a week apart, if possible, and to treat each area three times, then to stop treatment completely for three or four weeks, when each area can be covered again twice in a similar manner." Radium needles are resorted to if the disease localizes itself to a single nodular mass, which ceases to respond to treatment. "Ten milligrams of radium element in the form of needles can be introduced into the tumor tissue approximately one centimeter apart and left in place six to eight hours, or two centimeters apart and left in place twelve to fifteen hours."

The conclusions drawn are as follows:

(1) Every case of carcinoma of the thyroid that has been operated upon should receive, as soon as possible, at least two thorough courses of roentgen

ray treatments, and more if the disease has not been completely removed so far as the surgeon can recognize.

(2) If a diagnosis of carcinoma of the thyroid can be made, without operation, a reasonably good hope of success can be entertained by radiation treatment.

(3) Recurrent cases can be made to respond to treatment and the recurrence can be made to disappear, but the definite metastases are not likely to be controlled in late cases.

(4) Radium can be combined with roentgen ray treatment to good advantage in carcinoma of the thyroid when the tumor has become definitely localized or when it ceases to respond to the roentgen rays.

Treatment of Brain Tumors by Radiation. Henry K. Pancoast, M. D., University of Pennsylvania. Am. J. Roentgenol., January, 1922, p. 42.

Brain tumors are as a rule comparatively slow of growth and do not tend to metastasize and are therefore peculiarly adapted to treatment by radiation.

If the growth is localized and accessible it may be exposed and left intact, or it may be partially or completely removed and subsequently treated by radiation or by direct implantation of radium, or by cross firing through the skull. Cross firing holds possibilities in even inaccessible tumors or in those not localizable.

The dangers are comprised under (a) infection caused by radium needles or implanted tumors or infection dependent upon leaving the wound open for the removal of these; (b) the effect upon the flap and upon subsequent healing as a result of external cross fire; this cross fire may be postponed until healing is well under way, however, and since the dosage is a safe skin dosage necrosis of the flap will then be a remote possibility; (c) the effect of radium radiation directly upon normal brain tissue.

This last possibility demands careful consideration. The technique must be based upon the known ability of the normal brain tissues to withstand definite amounts of radiation by implantation or by external cross fire.

Animal experimentation was resorted to to establish these facts. This experimentation was carried out upon dogs at the University of Pennsylvania and the following facts have been thereby established: A dose of nine hundred milligram hours with well filtered radium on the surface of the brain is practically safe, but no dose should exceed eleven hundred and fifty to fourteen hundred milligram hours and might better be well below fourteen

hundred. The safe dosage for implanted tumors is much smaller than the safe surface dose. When actual destruction of normal brain tissue is apt to result the therapeutic dose from implantation must be comparatively small. The well filtered dose may be higher than the unfiltered and tumors act as a filter in protecting the normal tissue.

Because of the great difference in size between the human and the canine head—and because of the comparative safety of the procedure with humans—no animal experimentation was made with external cross fire radiation. Nausea and possible collapse are possibilities to be kept in mind in cross fire treatment and slow procedure is therefore wise.

The technique employed in the treatment of brain tumors is based upon the following factors:

(1) Safe, yet sufficient dosage (based upon clinical and experimental experience).

(2) Implantation contraindicated when removal has taken place, unless a large cavity persists which will permit of the radium being packed in the center.

(3) If the growth has been partially removed, or not removed at all, then the implantation dose depends upon the size of the tumor and its nature—with due regard to the normal brain tissue the destruction of which must be distinctly limited in the brain.

(4) Knowledge of the pathological nature of the tumor is essential.

(5) Dosage for brain tumor is approximately the same as for tumor of same size and nature elsewhere in the body, providing it is not one peculiar to the brain.

(6) Implantation must usually be supplemented by external cross fire.

(7) Cross fire radiation can be repeated with slightly reduced dosage over each area as soon as the skin reaction has subsided.

Cases are grouped as follows: (a) tumors accessible to the surgeon and presumably completely removed; (b) tumors accessible to the surgeon and partially removed; (c) tumors accessible but not removed; (d) tumors not localized or not found at operation; (e) pituitary growths. A general technique is given for each specific group named.

Thirty-two cases have been treated and four considered to have the most important bearing upon this subject are discussed at some length. The writer regards his experience in radiation therapy of brain tumor as very encouraging and full of promise.

Roentgenotherapy of the Thyroid. A. F. Tyler, M. D. Am. J. Roentgenol., January, 1922, p. 25.

ONLY cases of hyperthyroidism are here considered. This includes the typical exophthalmic goiter, the lymphatic toxic goiter and the toxic adenoma.

Roentgen ray therapy of goiter has been in use since 1898 and brilliant results were secured even with the old time methods. The improved technique and methods in use today owe a great deal of their efficiency and usefulness to Pfahler and to Holmes.

The three types of goiter mentioned above are the ones suitable for radiation therapy. Of these three toxic adenoma responds most quickly, next hyperplastic goiter, and last exophthalmic goiter. All other forms should be treated either surgically or by other medical means.

Accurate diagnosis is therefore very necessary and a thorough clinical examination by some one competent is absolutely requisite. First, all family and personal history should be secured. Blood pressure, pulse, temperature and heart should be taken note of and an x-ray examination of all the teeth and accessory sinuses must be made. The tonsils should also be examined for the question of focal infection is an important one in this disease. A fluoroscopic examination of the chest together with plates of the same should be made and lastly a basal metabolism estimation should be secured.

For ambulatory patients the x-ray is employed using ten and one-half inch spark gap, six mm. aluminum and one mm. sole leather, eight inch anode-skin distance and six ma., giving fifteen minutes over each area (one over each lobe and one over the thymus region). This dosage is repeated in four weeks and three such treatments are usually enough.

Radium therapy is used with hospitalized patients—this to avoid excitement and physical exertion.

Caution must be used in treating severely toxic cases and this is where the metabolic test is invaluable.

There is a close relation between the function of the thyroid and that of the ovaries, and in some cases where the symptoms indicate it, treatment over the ovarian region as well as over the thyroid has brought success.

The importance of the metabolic test as a check is stressed. It must be understood that with roentgenotherapy the basal metabolic rate gradually declines to normal in from three to twelve months and no immediate and rapid decline is to be looked for.

With proper technique myxedema is not produced. To avoid producing it

and to protect the trachea and larynx the isthmus should be protected from radiation.

The advantages are the avoidance of surgical shock and therefore lessened mortality, and the usefulness of this method when surgery has failed or is impossible.

X-ray in Tuberculosis. R. W. Morse, M. D., Glen Lake Sanatorium, Minneapolis. Journal-Lancet, March 1, 1922, p. 110.

THE x-ray is being used more and more in the diagnosis of pulmonary tuberculosis. It should not be looked upon as a rival of other methods of diagnosis, but as an aid. It is a remarkably accurate method and its greatest value lies in negative diagnosis.

Stereoscopic plates are of primary importance in the determination of pulmonary pathology. Fluoroscopy, while it has its place in this diagnosis, is useless in detecting small infiltrations of the lung or in detecting the character of gross lesions.

Breathing during exposure and over exposure are common faults of technique often leading to wrong diagnosis.

From the standpoint of the roentgenologist there are three types of pulmonary tuberculosis, namely, pulmonary miliary tuberculosis, peribronchial tuberculosis, and parenchymal tuberculosis.

The first type offers little difficulty in diagnosis. It is characterized by the presence throughout both lungs of millet-seed-like infiltration.

The peribronchial type is characterized by linear markings, numerous in number, thickened, fuzzy in outline, nodulated and extending beyond a line drawn parallel to the chest wall, which line extends from the junction of the inner and middle thirds of the clavicle to the base—or such markings may extend above the clavicle.

The diagnosis of parenchymal tuberculosis depends upon the involvement of the air vesicles themselves which form a conglomerate tubercle. The density varies from a slight haziness through cellular infiltration and fibrosis to calcification. This type is nearly always of clinical importance but peribronchial tuberculosis is not always so.

Differential diagnosis of pulmonary tuberculosis offers several limitations and the accuracy of diagnosis will depend entirely upon the experience and judgment of the roentgenologist. Determination of the activity or non-activity of a tuberculous lesion is outside the province of roentgenology.

Purule tuberculosis probably forms a definite entity, but the adult type may occur in the child and vice versa

The x-ray is of value also in the early diagnosis of ulcerative tuberculous enteritis, tuberculous osteo-arthritis and pyodermatitis. In the latter lesions it is important to take both the suspected and the normal joints on the same plate or comparison and to avoid differences in technique. Tuberculous osteomyelitis is very hard to differentiate from other infections.

As to therapy, the x-ray treatment of tuberculous adenitis is established as the method of choice. The writer states that his experience is limited as to the therapy of tuberculous skin lesions. He believes that great conservatism should be the rule in advocating or administering x-ray therapy in genital and peritoneal tuberculous, tuberculous bones, tuberculous enteritis and pulmonary tuberculosis as too little is known thus far to justify any other course.

The Possible Relation of Secretion to Cancer. Elliott C. Prentiss, M. S., M. D., Southern M. J., March, 1922, p. 181.

THIS is a suggestive treatise with deductions drawn from a rather extensive and comparative study of the literature upon gastric and duodenal ulcer and cancer of the digestive tract below the mouth.

The observation is made that cancer of the stomach, crossing into the duodenum, is occasionally benign in the duodenum and that ulcers of the duodenum crossing into the stomach often become malignant there.

The fact that cancer of the stomach seems to grow more slowly after a gastro-enterostomy is regarded as suggestive of the presence of some inhibitory chemical in the collective secretions of the liver, pancreas and duodenum.

Secretion is present in the entire small intestine almost as far as the cecum. It is most concentrated in the duodenum and from there gradually decreases in amount. It is entirely absent in the esophagus, the last two feet of the ileum and the whole of the large intestine.

In support of his views the writer cites the following points: (1) Ulcer of the duodenum is as frequent as ulcer of the stomach, but the same is not true of cancer of the duodenum, and in most cases of cancer of the duodenum the lesion is at the papilla duodenalis and is really not duodenal, but involves the bile duct. (2) Ulcer of the duodenum is apparently not a predisposing factor in the incidence of duodenal cancer. (3) There is some chemical present in gastric epithelium and not present in gastric epithelium that prevents cancer, or else there is some

chemical present in gastric epithelium and absent in duodenal epithelium that predisposes to cancer. (4) This latter substance, if present, is not HCl or pepsin, as the ulcer bearing area of the duodenum is constantly exposed to them. (5) This protecting substance is in the whole of the small intestine, except perhaps the lower end of the ileum. (6) Cancer of the gastro-intestinal tract below the mouth is rare where secretion is present, and relatively common where it is absent. (7) This protecting substance is present in the collective external secretions of the liver, pancreas and duodenum. (8) The liver being the largest secreting gland in the body and infection being so frequent there, we would naturally expect primary cancer in it to be common, but it is rarely found there. Secretin is taken directly to it by the portal circulation and in the greatest possible concentration. (9) The pancreas is a smaller secreting gland than the liver and infection is less frequent, but cancer is more common there. Secretin gets to the pancreas by the general circulation, therefore, in much less concentration. (10) Metastatic carcinoma of the liver is not as frequent as is the total number of cancers in the lower end of the esophagus, stomach, intestines and pancreas. Considering the relation of these organs to the portal circulation this is interesting.

Radium in the Treatment of Uterine Cancer. C. O. Donaldson, M. D., and G. E. Knappenberger, M. D., Kansas City, Mo.

NOWHERE in the field of radiology are the results more encouraging than in the treatment of uterine cancer, though the writers disagree with those who would exclude surgery with this field.

Within the last two years and one-half sixty-two cases of cancer of the uterus have been treated with radium by the authors of this paper. Eleven of these were post-surgically treated, the others were inoperable cases. Only five of the entire number were early, localized, or operable and these five are alive and well at the present time. Of the others, ten are dead, ten are lost track of, fifteen are clinically well, twelve have developed recurrence or metastases, and ten are still under treatment.

Biopsy was at first employed, but is now regarded as unwise. Trauma from the placing of radium is also most carefully avoided.

All operable cases, the writers believe, should have pre-operative radium and x-ray treatment to minimize the danger of trauma at operation, and to utilize the uterus as a filter. Also in

using radium it is easier to protect the bladder and rectum before a panhysterectomy than afterwards.

As for palliation in doomed cases radium has no equal. Clinical recovery in some of these extreme cases has extended to eighteen months, but its permanency is not hoped for.

Fifty milligrams of radium element, screened with 0.5 mm. silver and one mm. of brass, usually with a heavy rubber tube over the brass capsule, is inserted into the cervical canal. Sometimes twenty-five milligrams of radium element is inserted in this way and twenty-five more placed across the cervix with a "T" applicator. Usually three to four twenty-four hour treatments with a twenty-four hour interval between them are given. The extent of the disease, the size of the vagina, and the patient's ability to take treatment are governing factors in the treatment. Thirty-five hundred to four thousand milligram hours per week is the usual amount given.

After the pack is removed the patient is allowed to be out of bed, largely for the psychological effect. Close observation is made for two weeks following the treatment and x-ray therapy begins as soon as any constitutional reaction is gone. Routine examination is made every two months.

diagnosis.

The writers stress the responsible role of the general practitioner in early The Treatment of Malignant Neoplasms of the Tonsil, Douglas Quick, M. D., New York City. J. Radiol., May, 1922.

NEOPLASMS of the tonsil are usually noted early and often receive the wrong type of treatment for lack of proper diagnosis. Lymphosarcoma is the most common neoplasm in the young, and because of its many atypical forms, is often reported as some other variety.

Matthews in an extended report (1912) did not regard surgery with favor. On the use of roentgen ray and radium there are but few reports, so that statistics are not available.

Lanevay's method of radium emanation buried interstitially has been in use at the Memorial Hospital for the past five years and has proven of estimable value.

The treatment of all intra-oral carcinoma is divided into two stages—treatment of the primary growth and that of the cervical nodes. All primary lesions, the author believes, should be treated by radium alone. Treatment in all cases should be based upon the prognosis—some cases may be given only palliative treatment and some must be temporarily relieved through medicinal means.

Complete regression from a single dose should be the aim both from the point of the patient's interest and the ease of treatment. For palliation smaller amounts oftener applied are used. Dosage and technique are given in detail.

The treatment of cervical nodes consists of a combined treatment of radiation and conservative surgery, however, surgery plays no part in the treatment of cervical extensions of lymphosarcoma or malignant granulomas.

One hundred and forty-nine cases of malignant neoplasm of the tonsil have been treated at the Memorial Hospital during the past five years. Mistakes of treatment are acknowledged in many cases, but favorable results were secured in many others.

The conclusions drawn are as follows: (1) In all malignant neoplasms of the tonsil radiation is the agent of choice for treatment of the primary growth. (2) Best results can only be obtained in these cases by interstitial radiation—either by means of radium emanation or lightly filtered needles containing radium element embedded in the growth. This should be supplemented by heavily filtered external radiation—either x-rays or radium. (3) The treatment of cervical metastases of carcinoma of the tonsil is best managed by a combination of radium, x-ray and conservative surgery. (4) In lymphosarcoma or the malignant granulomas of the tonsil, surgery plays no part. Metastases to the cervical nodes or elsewhere should be managed entirely by a combination of radium and x-rays. (5) Experience encourages continuation of treatment along these lines.

Three Cases of Sarcoma Treated by Radiation. D. Y. Keith, M. D. and J. P. Keith, M. D., Louisville, Ky. *Am. J. Roentgenol.*, January, 1922, p. 31.

THREE very unusual cases are here reported. The first case had had a small pigmented tumor, located in the suprasternal notch, removed by surgery. Recurrence took place one year after operation and the growth was again removed and again recurred, this time within three months. The surgeon stated that at the last operation it had been impossible for him to remove all of the pigmentation. At the time roentgen ray treatment was begun there was present deep in the episternal depression, a black mass the size of a navy bean, spongy upon palpation and jelly-like in appearance. Six months after treatment was begun complete regression had taken place, and now, more than five years later, there is no evidence of return. Treatment

was continued at regular intervals up until December, 1920.

The second case had been operated twice for a growth in the left side of the neck, and had been operated a third time to remove several enlarged glands lying just over the carotid artery. Eighteen months later the enlarged nodules had again been removed and the pathologist's report was "malignant tumor rapidly growing—possibly metastasizing from a tumor in the central nervous system" and in addition he asked the privilege of post mortem study in the event of fatality. Five months later another operation was performed and a diagnosis of melanotic sarcoma, metastatic, was made. Several nodules the size of shelled peanuts made their appearance after this operation, and four months from the time of the operation x-ray therapy was instituted. Within sixty days the nodules had disappeared and the patient is now well and free from recurrence, thirty-three months since the date of the first treatment.

The third case was a patient who had developed swelling and pain in the right pectoral muscle following upon violent exertion. She had been treated for pneumonia with no relief, and upon presenting herself to the radiologist there was marked edema of the arm and hand, marked glandular enlargement of the axilla, together with a tumor the size of an orange in the upper half of the mammary gland, with such induration that it was not possible to say at the time whether the tumor was in the gland or in the pectoral muscle. Roentgen ray therapy relieved the pain within a week. The edema completely disappeared and at the present time, fifteen months since treatment was begun, there is no evidence of tumor anywhere. Two months after treatment was instituted the patient insisted that she was well and wished to discontinue treatment, but she was persuaded not to do so, and at present is under orders to report at regular intervals of three months for the next two years.

Fractures of the Carpal Scaphoid. Albert M. Pfeffer, M. D., Baltimore, Md. *J. Radiol.*, May, 1922.

FRACTURES of the carpal scaphoid are a clinical entity, so recognized since the advent of the x-ray. So-called sprains are often fractures of this type and escape detection at the time of occurrence.

These fractures are usually the result of violence, falls or accidents, such, for example, as occur in cranking a motor.

Because of its position in the skeletal structure the carpal scaphoid is more apt to be injured in these acci-

dents than either the os magnum or the radius. There are three types of its fracture; the greatest number of these are the simple transverse type, the second type is the transverse type with impaction of fragments, and the third type is a fracture of the tuberosity. The general tendency of these fractures is to remain ununited. They are apt to be complicated.

It is often from two months to two years after the fracture before the symptoms of weakness or pain in the wrist demand attention. There is usually found a history of "sprain" or perhaps of Colles' fracture. The early symptom is swelling, often appearing almost instantly after accident; it is limited to the radial side. Upon palpation severe pain is found immediately over the scaphoid. The Vaughan knuckle percussion test is a reliable sign. Changes in measurement from the radial styloid to the end of the second metacarpal bone is disputed as is wasting also. Echinosis is absent, and crepitus also, as a rule.

Inexperienced x-ray diagnosis is apt to be misleading because of the peculiar shape and position of the carpal scaphoid. The technique must be precise. Plates must be made at different angles and in different positions, and in doubtful cases it is well to employ the fluoroscope because this allows of observation during movement from the supinated to the pronated position, during which a fracture will be detected which otherwise would escape detection. Stereoscopic views should be employed. Diagnosis can in many cases be made from history and clinical findings alone, but a radiogram and fluoroscopy are decisive.

There are possibilities of variation from the normal in the scaphoid bones and these variations must be considered. Some scaphoids consist normally of two or three parts.

Diagnosis of Pulmonary Conditions in Children. John W. Pierson, M. D., Baltimore, Md. *Am. J. Roentgenol.*, January, 1922, page 11.

A SERIES of children ranging in age from one day to eighteen months were examined for the purpose of determining how early the markings, so familiar at the roots of adult lungs, are found in children.

Tiny circular shadows (two or three millimeters) were found at the ends of the major divisions of the bronchi, as early as the first day. These became more clearly defined as time went on and were heavier in children who had had pulmonary infections. The conclusion from the study is that certain minor changes must be expected in the lungs of all children. As to how far

these changes may go before being considered pathological has not yet been determined, but this is being investigated.

In the writer's clinic eighty children were examined and forty-eight showed changes which were diagnosed by the x-ray as pathological, but the physical tests gave only fifteen. The author considers that the x-ray diagnosis was far too critical in this series and he states that there are many factors which cause changes in the lung picture and which at the same time have no bearing upon the case.

Acute bronchitis can not be demonstrated by the x-ray, but lobar pneumonia is very easy to demonstrate. The latter when it has cleared leaves no markings, but broncho-pneumonia leaves markings which remain for a long time. This latter lesion in its acute stage is characterized by areas of consolidation of varying size with indefinite outlines. These are usually found at the base of the lung, but they may be anywhere. They are sometimes impossible to differentiate from consolidations of tuberculosis, especially if the chronic stage of bronchopneumonia has been reached. Both tuberculosis and bronchopneumonia cause fibrosis.

Tuberculous lesions in children are not always found in the upper lung, as is usually the case with adults, but may be found anywhere. As the child grows older the characteristic fan-shaped lesions appear. There is one sign which is regarded as being almost pathognomonic of tuberculosis and that is the enlargement of the mediastinal glands, but the writers insist throughout that the x-ray findings alone must not be relied upon, but must be considered in conjunction with other findings.

Some Points in the Physics and Technique of Roentgen Ray Work. A. L. Gray, M. D., Richmond, Va. Southern M. J., March, 1922, p. 185.

A MINIMUM of apparatus for necessary work should be the rule.

In a hospital having fifty to one hundred beds the roentgen ray department should have an operating room which can be darkened and which is of sufficient size to admit a wheel stretcher and table. There should be an adjoining room with the wall toward the operating room lead lined and containing a leaded glass window with the lead overlapping the glass on all sides. This room may contain the generator and control switches and may also serve as a demonstrating room and may serve for storage of plate files and records. A third room is necessary for a dark room, which should be conveniently

located to and amply protected from the operating room.

The transformer need not have auto-transformer control, but should have a sufficient capacity to pass sixty milliamperes through a tube backing a six inch parallel gap. A combination stereoscopic and fluoroscopic table which can be put up vertically or horizontally and also tipped at various angles, at will, is necessary. Wire or brass tubing may be used for the aerial trolley system. Connections, fastenings and insulations must all be carefully and frequently inspected.

The large type of transformer must not be operated in the same room where fluoroscopic observations are made and the auto-control of a transformer should never be utilized in a darkened room.

The meters (usually accompanying the transformer), a Coolidge transformer and meter and a portable control, a stereoscope, protecting apron and gloves complete the necessary equipment for the operating room. For the dark room will be necessary a small six-compartment soapstone tank, or else two steel tanks in a galvanized iron or stone tank, a thermometer, a dark room light, plate racks and developing frames for films and plates and a pair of intensifying screens of each of the following sizes: 14x17, 11x14, 10x12 and 8x10.

Methods of identifying the plates, of taking stereoscopic chests and head plates and of differentiating a calculus in the kidney from one in the gall-bladder are given. An apparent filling defect in the fundic or antral portion of the stomach often disappears when a four inch sand bag is placed under the patient's thighs so that the weight of the body rests upon the chest and thighs and the stomach becomes distended.

A Review of the Course and Treatment of Carcinoma Uteri. By A. Norman McArthur, M.B., B.S., M.R.C.S., L.R.C.P., St. Vincent's Hospital, Melbourne, Australia. The M. J. Australia, February 11, 1922, p. 145.

THE data for this paper has not been secured from the literature, but from the author's extensive experience.

To his mind there are but two methods of treatment, surgery and radium, and all others are worse than useless.

Some rather unflattering observations are made upon the "lack of diagnostic acumen" displayed by the general practitioner. The writer takes occasion to ask if this seeming carelessness may not be due to the so-called contract practice in which the over-

worked and underpaid general practitioner loses initiative and becomes callous to symptoms. The specialist also comes in for a share of rebuke. The writer charges that many, many cases might be saved a fatal termination were it not for this seeming ignorance or else carelessness in regard to important early symptoms.

He makes it very explicit that there is no age limit, citing three cases in his own experience under twenty-seven years of age and quite a number under thirty-five. Cachexia is not present in all cases by any means. Hemorrhage is a dangerous symptom too often passed by and pain is a symptom of the later and hopeless stage of this disease.

The Wertheim panhysterectomy is the surgical procedure preferred by this writer. He uses this with a slight modification. Vaginal hysterectomy he states may be useful in early cancer of the uterus, but at no other time.

Recurrence has always been the surgeon's great problem, but in the latter years the roentgen rays and radium have come to his aid. The use of radium is favored rather than the roentgen rays because of the exacting technique for these and because of the fact that they are less penetrating than the radium.

Radium renders many an apparently hopelessly inoperable case operable. It reduces pain, checks bleeding and diminishes offensive odor, reduces inflammatory thickening and sterilizes outlying cancer cells. Contrary to finding connective tissue developed by the use of radium this writer finds that radium seems to gelatinize any connective tissue with which it has come in contact and renders operation less difficult. Radium, he states, "is the greatest ally the surgeon has ever had in these dreadful cases."

The Superficial Reaction of Radium as a Guide to Dosage. William S. Newcomet, M. D., Philadelphia. Am. J. Roentgenol., January, 1922 p. 34.

THE more flexible the radium unit the better will be the results. Several small units are preferable to one larger one.

Sometimes local abatement in one area and progressive growth in another occurs. It is then best to stop all treatment for several months, when treatment may again be resumed.

The reaction from radium, while not generally considered as dangerous as that from x-ray, will give practically the same results under similar circumstances, and any modification is due rather to a difference in application than to a difference in radiation. The ery-

thema dose is the standard with the roentgen ray and is worked out by the factors of distance from the anode, strength of current, etc. With radium the results depend upon the amount of radium element, distribution of radiating material, time of application, duration and intervals, distance from the part, style of container and kind of filters.

Any modification of these factors will produce a difference of result, namely, one hundred milligram hours may produce quite different effects, according to the amount of radium element and the proportionate time employed. Expression of dosage by milligram hours alone is a fallacy which the writer goes into some detail to prove. If the beta radiation is not removed the surface radiation will be then so great that a comparatively small dosage will cause superficial ulceration. Time as a factor must be considered according to the area covered and also in connection with the areas in the immediate vicinity.

The character of the tissue must always be considered, especially if previous irritation from other sources has existed. Late reactions and ulcerations have sometimes been caused by irritants applied after radiation.

In pathological structures the variation is far wider than it is in normalcy.

These factors and features are all elaborated upon in relation to the theme of this paper. The author states that there is no pretense of entering into any scientific detail as to exact measurements, nor of entering upon any microscopical study of tissues in various stages, but that this article is based upon a large number of applications to prove some facts which were observed in the ordinary treatment of a large number of cases.

A Comparison of Radiation Dosages Attainable by Use of Radium on and Within Tumors. Charles H. Viol, Ph. D., Pittsburgh. *Am. J. Roentgenol.*, January, 1922, p. 56.

The points brought out by Friedrich and Kroenig in regard to increased radiation dependent upon secondary radiation are interesting and important, however, the fact remains that clinical results must remain the measure of value of any method and of any technique.

For deep x-ray treatments massive doses are required and the limiting factor is usually the tolerance of the skin. When massive doses are employed bad systemic results follow even when the haster rays are used.

Radium, however, may be brought in contact with even a deeply seated growth and radium emanation has been

implanted in tumors since 1914. Metal radium needles containing radium salt have also been employed and found satisfactory.

"The immediate problem in radiotherapeutic treatment of a localized malignant growth is to secure an adequate or lethal dose of rays in the farthest outlying cells."

The intensity of the rays from a small source varies inversely as the square of the distance from the source, and if the distance between the radium and the farthest outlying cells is reduced to one-half the first distance (by insertion into the tumor mass) the ray dose will therefore be increased four times. This gives the nearest approximation to homogeneous radiation, secures the most intense effects of radiation within the tumor, and avoids the waste resulting from cross fire, together with the possible undesirable effects therefrom upon adjacent normal tissue.

The writer believes that the only hope of successful radiotherapy in malignancy of the bladder, prostate, and stomach lies in a method by which the radioactive substance will be placed throughout the mass of neoplastic tissue.

The possibility of enhancing the action of x and gamma rays by means of radiators, such as implanted metal needles, injected colloidal metals or salts is discussed. The writer believes that the support of this view is not logically founded and quotes experimentation by Frederick and Binder in support of his attitude. These workers found the radiation intensity to be less with radiators than without them.

Radiotherapy in Carcinoma of the Breast. George E. Pfahler, M. D., Philadelphia. Abstracted in *Bost. M. & S. J.*, March 9, 1922, p. 318. Read before the Suffolk District Medical Society, Massachusetts, January 25, 1922.

RADIO THERAPY in carcinoma of the breast can be divided into three parts:

(1) Ante-operative and post-operative treatment. In this group of cases there should be a conference between the radiologist and the surgeon before deciding upon any course. Ante-operative treatment is justified by both theory and experimental investigation. This treatment requires approximately two weeks, at the end of which time the patient can be operated upon. Post-operative treatment should begin approximately two weeks after the operation has taken place and will take an additional two weeks of treatment. Unless the disease is very far advanced the patient is then observed once a

month for a period, and later on, at longer intervals.

(2) Recurrent and metastatic cases always give unfavorable prognoses, but sometimes brilliant results can be obtained. The most thorough radiation possible should be given to the local recurrences and the local metastases, but the general area likely to be involved by metastases should be included in treatment. In all primary operative, and recurrent cases of cancer of the breast, a roentgenogram of the chest should be made. Radium can sometimes be used to advantage with the x-ray in controlling recurrences and metastases.

(3) Primary carcinoma of the breast has been studied mostly in the inoperable and more or less hopeless cases. Some of these have shown remarkable response to treatment, and occasionally an inoperable case can be made operable. In primary cases it is advisable to treat the patient over the carcinoma and the general glandular distribution thoroughly with the x-rays first, and then follow with radium introduced directly into the tumor mass at about the time that we would otherwise do an operation. Close co-operation between the surgeon and the radiologist will produce better results than can be obtained in any other way.

X-ray Treatment of Carcinoma of the Breast. Arthur W. Erskine, M. D., Cedar Rapids, Ia. *Illinois M. J.*, March, 1922, p. 209.

WHETHER intensive radiation should be employed in addition to surgery in treating these cases must be judged from the results already obtained. The rays have been used in these cases for the last twenty-five years and the results obtained throughout these years, and especially those obtained with the use of modern methods, furnishes abundant justification for continued treatment of such cases.

These results make it reasonable to expect from the present ordinary intensive radiation a twenty-five per cent increase in the number of patients alive five years after operation. Also it is reasonable to expect prevention of ulceration and breaking down of the tumor, destruction of superficial metastases, prolongation of comfortable life and finally an easy death.

In regard to operability two opposite views are held by radiotherapists. One group holds that the presence of metastases renders the cancer inoperable and that here x-rays and radium are the best means to employ. The second group holds that the intensive use of x-rays has widened the field of operability and that whenever the primary

umor can be removed with a reasonable expectation of the skin closing at the operation should be performed. This latter is the author's view.

Since metastases may be present in any part of the chest, routine post-operative x-ray treatment should be the same in all cases, regardless, and the dosage should be large enough to inhibit the growth of cancer cells.

Attack is made from four directions at a distance of sixteen inches; copper filters, the equivalent of ten mm. of aluminum, one hundred thousand R. (1.5 S. voltage, five ma. passing through the tube, are the points in the author's technique. He states that whether to attempt a lethal dose at one sitting is a question which calls for courage in solution.

Errors in the Roentgenologic Diagnosis of Duodenal Ulcer. Russell D. Carman, M. D., Rochester, Minn. 1. Radiol. May, 1922.

ROENTGENOLOGIC diagnosis of duodenal ulcer is today easily accomplished and the percentage of error is slight.

The only trustworthy indications in his diagnosis are deformity of the duodenal contour and the combination of retention and hyperperistalsis in a large out otherwise normal stomach.

The causes of error may be affirmative or negative. The former may be due to faulty technique or examination, or confusion of pathological identities, or may be due to over-emphasis of some minor point not in itself indicative of this lesion. The negative errors may be due to faulty technique, ignoring the duodenum in case of other pathology, unfavorable position of the duodenal bulb and actual or apparent absence of bulbar deformity. All these sources of error are discussed in the original paper.

In a series of cases covering the year ending June 30, 1921, out of five hundred and twenty-two cases diagnosed as duodenal ulcer four hundred and ninety-nine were proven at operation. The writer is hopeful that the small percentage of mistakes in diagnosis will be still further reduced. He does not believe that clinical facts should be employed by the roentgenologist in making his diagnosis, as this has been found to lead to mistakes.

The author's conclusions may be found at the close of the paper published in the scientific section of this number of the Journal.

Notes on Twenty Cases of Ulcer of the Leg, Treated by Electrical Methods. C. A. Robinson, M. B., D. M. R. E., West Middlesex Hospital, St. Bartholomew's Hospital, London.

Arch. Radiol. & Electroth., January, 1922, p. 253.

THOUGH one of these cases was syphilitic, the principal factor of causation in all others seemed to be a stagnation or congestion in the circulation of the legs. The underlying constitutional cause is believed to have been a deficiency in ionized calcium and other metals in the blood, due perhaps to deranged endocrinal function. Also in many cases scarring had left the ulcer deprived of its vascular supply. Not one case had well marked varicose veins, but the feet and lower legs were cold, subjectively and objectively, and were cyanosed.

To increase the amount of blood flowing through the surrounding tissues a direct current with the cathode applied to the ulcer was employed. This removed crusts and scabs and allowed free discharge of pus. Phagocytosis was thereby increased and all the processes of natural defense quickened.

Of the twenty cases, four were definitely successful within two weeks to two months, five are healing rapidly at present. Four were definite failures. Seven are regarded as inconclusive because five of these were treated less than eight days, one case was of twenty years duration and one was found to be syphilitic and healed rapidly upon an injection of novarsenobenzol.

Some Practical Applications of Ionization Measurements of X-rays. Arthur W. Erskine, M. D., J. Radiol., May, 1922.

THE conclusions drawn in this paper are based upon the three assumptions that Dessauer's theory of homogeneous radiation is correct, that the ionizing effect and the physiological effect of x-rays are somewhere near the same, and that the absorption power and scattering rate of x-rays in water approximates the rate in human tissue.

Assuming that the action of x-rays on deep seated tissue is purely destructive, the problem in deep therapy is to deliver a sufficiently large dose to deep structures without injury to the skin.

Experiments carried out verified the belief that increasing the voltage, size of fields, anode-surface distance and thickness of filter increased the percentage of radiation delivered to the depth; not only this, but there seemed to be a definite mathematical relation between the four factors.

Various changes in the factors of technique were experimented with to determine the effect upon the ratio between the surface and depth dose. These experiments are fully described and data given with accompanying plots and graphs.

From these experiments the writer

concludes that increased voltage lowers the surface depth ratio and lessens the time required for administration of a given dose, the capacity of the apparatus being the limit of desirable increase in voltage; the intensity being nearly uniform the entire beam may be used; the field should be at least fifteen cm. square; anode-skin-distance should be just great enough to allow the entire surface to be treated at one time, the limit of economical increase being usually between fifty and sixty cm. for anode-skin distance; for filter thickness this limit is dependent upon the voltage employed, about 0.4 mm. Cu for 130 to 140 kv. and about .75 mm. Cu for 200 to 220 kv.

Studies on X-ray Effects. The Action of Serum From X-rayed Animals on Lymphoid Cells in Vitro. James B. Murphy, M. D., J. Heng Liu, M. D., and Ernest Sturm. *From the Laboratories of The Rockefeller Institute for Medical Research.* J. Exper. Med., March, 1922, p. 373.

HEALTHY young rats were exposed to the x-rays, using the following technique: spark gap, two and one-half inches; ten ma.; distance, twelve inches; time, fourteen minutes. Animals were immediately anesthetized and exsanguinated.

"Approximately fifty-seven per cent is absorbed by the first one-fourth centimeter of tissue, and more than ninety-two per cent before the rays have penetrated to the depth of one-half centimeter, while at a depth of one and one-half centimeters only 0.56 per cent of the rays remains." It is thought doubtful whether these rays penetrate to the deeper lymphoid organs sufficiently to cause changes, though these organs show as much evidence of stimulation as do the superficial ones; which is suggestive that the spleen and lymph gland changes may be secondary to some alteration, caused by the x-rays, in the circulatory blood or other tissue.

This experiment failed to show any evidence of so-called lymphotoxin in the series of x-rayed animals, even after an exposure so long as to cause almost complete destruction of the living lymphoid tissue.

The following conclusions are drawn:

"Lymphoid cells, prepared from the thymus and lymph glands of rats, when suspended in the serum of x-rayed rats and incubated for two hours, increase in number from fifteen to thirty per cent, and mitotic figures are found among these cells in fairly large numbers. A like suspension of cells in normal serum undergoes rapid disintegration and in only one instance

among a large number of films examined was a mitotic figure found.

"The stimulative effect of the serum from x-rayed rats endures from one to two hours after the exposure, but is not detectable in the serum taken seventeen hours or later after the treatment. Serum rayed *in vitro* is devoid of stimulative action.

"The lymphoid cells of rabbits and guinea pigs are so fragile as to make impossible the obtaining of counts accurate enough for experimental purposes. The serum of one species caused such rapid disintegration of the cells of another that it was impossible to determine the specificity of the reaction."

The Principles of Electrotherapy and Their Practical Application. By W. J. Turrell, M. D., 1922. 8 vo. pp. 288. Oxford University Press, 35 West 32nd St., New York City. \$3.85.

THIS book contains twenty-nine splendidly clear illustrations. It is written in a simple, direct, almost narrative style. The bibliography is arranged at the end of different chapters.

The book is divided into four parts: (1) The Therapeutic Action of Current Electricity. (2) The Therapeutic Action of Radiant Energy. (3) Electro-Diagnosis. (4) An Outline of the Application and of the Mode of Action of Electricity in Certain Diseased Conditions.

For about ninety pages the subject of the therapeutic action of electricity is discussed under the sub-heads of the constant current, interrupted currents of low frequency, interrupted currents of high frequency and currents derived from the static machine. The author does not "beg the question" of the therapeutic action of the constant current by merely saying that its beneficial effects are due to ionic interchange which takes place in the tissues, but handles it in detailed fashion, bringing laboratory experiments and data from his own personal, practical experience to bear upon it. In like manner the other subheads are taken up. He himself has designed an instrument, electrically driven, for the surging of therapeutic currents of low frequency. He pays tribute to the Bristow coil, which he says is superior for obtaining the very valuable graduated contractions by the Bristow method and adds, "in fact I do not think any mechanically operated instrument can replace the personal factor of the operator, which is so essential a part of Mr. Rowley Bristow's method."

In the chapter on high frequency currents is an explanation of a method, termed "Indirect Surgical Diathermy,"

for removing minor blemishes of the skin and introduced by the author himself. The patient being charged from a diathermy apparatus with about five hundred milliamperes the operator applies to the part to be destroyed a pointed metal instrument to which no wires are attached. The current with which the patient is charged is attracted to the base of the growth and inductively attracts to the surface of the growth a similar current from the capacity of the operator. This oscillates over a million times a second, so that the destructive process operates almost simultaneously on the surface and at the base of the growth.

In the second division of the book is discussed radiant heat and light, ultra violet radiation, and x-rays. Here the author differs somewhat from some American scientists in the explanation of the therapeutic action of the x-rays. His opinion is that the more rational view of "the therapeutic action of the x-rays is to regard them as an intensified form of the action of the ultra violet radiation," which action is regarded "as due to the oxidation or reduction in the tissues resulting from the changes in valence produced by the electronic discharge caused by the resonant agitation excited in the cells by radiation."

Part three explains electro-diagnosis of peripheral nerve lesions and nervous and other diseases. The special value of the electrical tests is that they afford objective evidence in place of the subjective signs afforded by the other methods of observation. Aside from two very rare, almost negligible exceptions, a faradic current causes muscular contraction if there is an organic nerve lesion. In diagnosing diseases there may be faradic hyper-excitability or hypo-excitability, galvanic hyper-excitability or hypo-excitability, or complete inexcitability. As a general rule where the tendon reflexes are increased, both galvanic and faradic hyper-excitability will be found.

Part four is by far the largest of the four divisions of the book. It deals with the application and mode of action of electricity in certain diseased conditions, and as a surgical agent. It is written in an explanatory and almost prescriptive style, illustrated with cases, many of which the author has personally handled. An interesting example is that of a late war case of severe causalgia in a man having a wound of the right forearm, upon whom weak galvanic currents rapidly interrupted by a Leduc interrupter worked a most happy recovery, as far as the pain was concerned.

A Study of Renal Function in Roentgen Ray Intoxication. Resistance of Renal Epithelium to Direct Radiation. Irvine McQuarrie, M. D. and G. H. Whipple, M. D. *From the Hooper Foundation for Medical Research, San Francisco.* J. Exper. Med. Feb., 1922, p. 225.

NORMAL adult dogs were used in this study. Exposures were made with the hard roentgen rays of the Coolidge tube, the softer rays filtered out with two mm. aluminum. All exposures were percutaneous and the distance from target to surface was twenty-five cm. in each case. Eight ma. were used in most experiments though as high as ten and as low as five were used in some. A nine inch spark gap with an e.m.f. of about ninety kv. was used with few exceptions.

In part of the experiments moderate doses were given with rest intervals extending over a considerable period of time. Huge doses were given either singly or successively. Different body regions were exposed separately in the various experiments. Dogs were given only water three days preceding and five to six days following exposure. During rest periods they received the usual mixed diet.

The phenolsulfonphthalein elimination test was used to measure the kidney function. Daily determination of blood urea was made in all cases and the ratio of one hour's urine to urea per one hundred cc. of blood was determined in many cases.

The author's conclusions follow: "Our experiments give no support to the current belief that an x-ray nephritis may be produced by direct or indirect action of the hard roentgen rays.

"Moderate doses of x-rays given repeatedly over considerable periods of time have no demonstrable influence on renal function or renal structure.

"With x-ray exposure over the abdomen and shielding the kidneys fatal intoxication may be produced without the slightest disturbance of kidney function as measured by the ability of the kidney to eliminate phenolphthalein and urea.

"Large doses of x-ray given directly over the kidney may cause a slight but distinct lowering of renal function which lasts for a period of a few days. We have been unable to recognize any corresponding histological change.

"We feel that the usual therapeutic doses of the x-rays can be given without apprehension. The renal tissue is much more resistant to x-rays than is the epithelium of the small intestine."

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Cancer of the Lip Treated by Radiation or Combined With Electro-Coagulation and Surgical Procedures*

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DURING the war approximately 80,000 American soldiers lost their lives. During the same period approximately 180,000, or more than twice as many, people in the United States lost their lives from cancer. Cancer causes one out of every ten deaths after the age of forty in this country. Cancer appears to be on the increase in every civilized country. The death rate in the United States registration area increased from 63 per 100,000 population in 1900 to 81.6 in 1917. It was estimated by the American Society for the Control of Cancer that there would be approximately 100,000 deaths from cancer in 1919. With 100,000 people dying each year from cancer, it behoves us as physicians to use every possible means to reduce this death rate, and each and every method of treatment which has been proven efficient should be used, whether singly or combined.

A cancer death is, it seems to me, the most horrible of all deaths. It involves pain, often foul odors and discharge, often marked disfigurement, and always exhaustion of the patient and distress of friends. Death from cancer of the lip involves all of these disagreeable features. Of course, at the time of death, the cancer is no longer confined to the lip, but involves the face, throat and often the chest.

PROPHYLACTIC AND EARLY TREATMENT

In these latest stages, neither radiation nor any combination of treatment known today, can be expected to cure the patient. Therefore, to cure cancer of the lip, or any other form of cancer, it should be treated early and thoroughly. Thorough treatment of cancer of the lip must include radiation, no matter what other form of treatment may be used in combination. I believe

that the patient having cancer of the lip does not get all possible chances for recovery unless radiation is given. Whether radiation should be used alone or combined with other treatment is a matter for careful judgment in the individual case.

Every form of irritation affecting the lip should be removed, such as irritation from a pipe, cigarette paper, excessive cigar smoking, traumatism, irritation from a jagged tooth, or excessive exposure to heat, cold and wind.

Any fissure or crust formation on the lip that lasts over four weeks without complete healing should be looked upon with suspicion. If patients are thoroughly treated in these early stages, practically all should get well.

THE GENERAL PRACTITIONER AND THE PATIENT

As a rule the general practitioner is the first to see the patient. His advice and his treatment is likely to be the deciding factor between success and failure. He should not apply superficial caustics or irritants such as nitrate of silver. I believe that repeated applications of nitrate of silver stimulate the growth of cancer about the mouth. If in doubt as to the diagnosis or treatment, the general practitioner should consult with one who has had a greater experience in this special field. Such consultation today is always available, without regard to the financial condition of the patient. Very frequently the patient will avoid seeing any physician, because he fears that he will have to be operated upon, and for this reason he does nothing, or applies home remedies, drug store applications, or more frequently goes to a cancer quack who is likely to apply some caustic paste. It is this latter group of failures and delayed cases that make up the most distressing group any of us are called upon to treat. They come late, perhaps only for the treatment of the metastases, and because surgery or radiology fails in this group both methods are condemned by the patient and his friends; and his friends, like

himself, are likely in their turn to lose the best chances for recovery.

If, however, we let it be known that local application of radiation, thoroughly done, or local destruction of the diseased area by electro-coagulation followed immediately by thorough radiation of the adjacent tissues and especially the lymphatic areas, is likely to cure this lesion, and without much pain or interruption of work, the patient will be likely to consult the physician early.

This fact, however, increases greatly the moral responsibility of the radiologist, the general practitioner or the surgeon who undertakes this work. We should realize our limitations. Our motto should be thoroughness.

DIAGNOSIS

Any crust, fissure, or new growth on the lip that lasts over a month is at least potentially cancer. A careful taking of the history, and a study of the patient's habits, together with careful inspection and palpation will generally enable one to make the diagnosis. In this connection the possibility of a primary luetic lesion must be considered but a Wassermann test or consultation with a competent dermatologist or syphilologist will help to eliminate lues from the diagnosis. One must not permit the mere presence of a positive Wassermann test to eliminate the diagnosis of cancer. I have seen many failures in cancer about the mouth due to a prolonged course of treatment for syphilis, and neglect of cancer treatment. The local lesion in these cases is probably engrafted upon a syphilitic base. We must remember that a patient can have both syphilis and cancer at the same time. I believe that the removal of a section is inadvisable unless the disease is immediately destroyed and radical treatment given. Bloodgood⁽¹⁾ has well stated that the removal of sections for diagnosis followed by delaying the radical treatment only aggravates the disease and gives no advantage. If excision is to be done it must surround the disease or failure will result.

*—Read before the Joint Meeting of the American Radiological Society and the Chicago Medical Society, December 7, 1921.

RESULTS OF TREATMENT

I will only review the cases treated in my private clinic, because of the difficulties in tracing patients in the hospital clinics. Many patients have been treated in the x-ray departments of the hospitals. Most of these were postoperative or recurrent cases, and in many instances they did not consider themselves our patients. They looked upon the postoperative treatment as an unnecessary annoyance, and often prematurely discontinued treatment. The recurrent cases were generally far advanced, usually hopeless, and were referred to the department because there was nothing else to do.

The early cases will, of course, give the best results, and if treated thoroughly all should get well. Our records do not show that all do get well, but in the cases in which we failed the patients were difficult to manage. One had an associated luetic infection and developed an extension in the cheek and jaw after seven years. During this stage he died of pneumonia. It remains doubtful whether this induration about the angle of the jaw, but above the lower edge of the bone, was luetic or malignant, since we were not permitted to remove a section for microscopical examination. Another patient never returned after the first treatment. The third failure, I believe, was due to insufficient treatment at the very beginning. While there was no local recurrence, an indurated ridge developed at the inner border of the original lesion and extended downward and outward toward the right submaxillary gland. The side of the cheek from the angle of the mouth to the submaxillary gland became indurated and undoubtedly malignant. The patient became dis-

couraged, but at the time of the last visit the submaxillary gland was not palpable. It would seem that the treatment given to the submaxillary region was efficacious.

In another case, eighteen months after the primary lesion had disappeared, a metastatic lymph node developed in the submaxillary region. In looking about for the cause of this surprise we found that through some mistake in the office the patient had not received treatment over these glandular areas. While it is unfortunate for the man, it illustrates beautifully the importance of thorough treatment of the lymphatic regions by radiation, either with the roentgen rays or radium at the beginning, and subsequently sufficient treatment to insure thorough destruction of the cancer cells. This recurrent lymph node is now being treated, apparently with success, by the insertion of radium needles.

In my private clinic we have treated ninety-six cases of cancer of the lip; primary seventy-two, recurrent twenty, postoperative five. Out of seventy-two primary cases from my private records sixty-five recovered and have remained well from several months to eighteen years. Two have died of a continuation of the disease, two have a recurrence and in two the result is unknown.

I realize that such a record is not beyond criticism, because the duration of the results is variable, and other failures may have to be recorded. However, since the results obtained by my colleagues, Henry K. Pancoast and Wm. L. Clark, correspond so closely to my own, and were obtained by similar technique, and since the results in the older cases are most satisfactory, I am led to believe that our enthusiasm is

justified and that this method of treatment can be recommended.

The recurrent cases are always more difficult. Of the twenty recurrent cases treated, only eight recovered. Much will depend upon the promptness and thoroughness with which these recurrent cases are treated, but in part, at least, the results will depend upon the nature of the cancer or the degree of malignancy. One must obtain prompt results from radiation or failure is likely to result. Thorough radiation by the roentgen rays, and by radium when it can be combined to advantage, from the very beginning is most important. I never like to have a patient referred to me after some one has used insufficient radiation over a considerable period of time, and (recognizing failure) has concluded that perhaps more thorough radiation might produce good results. In such cases, unless the disease is so situated that it can be destroyed by electro-coagulation, failure will be the rule.

The five patients given postoperative treatment have remained well, though in none was there a block dissection.

TECHNIQUE

In the treatment of malignant disease, probably more than in any other field, skill and keen judgment is required. One must understand the nature of the disease and its lines of distribution. One must then use enough radiation to destroy the cancer cells and at the same time do as little damage to healthy tissues as is possible. Boggs⁽²⁾ says: "Too many failures have been accredited to radium, when as a matter of fact, through inexperience and lack of proper study, only partial doses were given." We must realize that the mere possession of a quantity of radium does not make a radiologist any more than the possession of a few surgical instruments makes a surgeon. The surgeon needs not only a thorough equipment of instruments, but knowledge, keen judgment, and skill; so, too, the radiologist needs a good equipment, a knowledge of the disease he is treating, and skill in the application of the radiation.

ELECTRO-COAGULATION

Electro-coagulation consists in the coagulation of the diseased areas by means of the heat produced by the high frequency current as it passes through the body from a point attached either to the Oudin current or to one pole of the d'Arsonval current. The Oudin current (unipolar) is used for small lesions, and the d'Arsonval current is used for the larger lesions. If the d'Arsonval current is used one pole is attached to a pad or smooth metal



Figure 1.—(a)—Dr. J. E. Bowman's patient. Epithelioma of the right side of the lower lip. Followed a cut with a razor two years previously. Had been treated previously with silver nitrate. No palpable glands. Destroyed by electro-coagulation February 27, 1915.

Figure 1.—(b)—Healed and apparently well April 9, 1915. Still well April 14, 1921, after six years.

electrode placed under the buttocks of the patient, while the active electrode is a point. This current is not selective in its action, but will destroy the tissues radiating outward from the point. One cannot use this current, therefore, in locations in which essential structures, such as important blood vessels or nerves, are located in the line of destruction. There will be a zone beyond the actual coagulation which will be superheated and will be sufficient to destroy cancer cells, but will not destroy the healthy tissue. In this way one conserves tissue, and as is shown by my own cases and those shown by Clark⁽²⁾ the defect, after the patient is well, does not nearly equal the amount of disease removed. There is, apparently, a regeneration of a part of the tissue removed. The heat is generated in the tissues. It is the penetrative value of this form of heat that makes it more desirable than that obtained by the thermocautery, which destroys only by transmitted heat, and, therefore, is essentially more superficial. The destructive value of the current used can only be learned by experience, but much experience can be obtained by practice with a piece of liver, or other meat. Such experience from practice with a piece of liver cannot be directly transferred, for the current value will vary with the shape of the lesion to be destroyed, whether small and prominent, such as a wart or mole, or flat and indefinitely outlined, such as carcinoma. The current value will also vary with the size of the mass or body to which the tissue to be destroyed is attached. The milliammeter is not of great value in judging the effects.

The tissue as it is destroyed by the high frequency current turns white, if it is coagulated, or if small, is dried up and sparked through the air. (Desiccation).

Selection of cases suitable for electro-coagulation is necessary. If the lesion is small, and its removal will not cause too serious a defect in the lip, I believe that such destruction will be followed by more prompt and more satisfactory results than by radiation alone. By such destruction we remove the macroscopical disease just as the surgeon does with the knife, but we do it without opening any blood vessels or lymph channels. If the lesion is fairly large I trim the destroyed tissue away with curved scissors, always carefully cutting within the destroyed area. In this way one eliminates part of the disagreeable odor which accompanies the sloughing process.

If the cancer involves the entire lip, or even half of the lip, such preliminary destruction by electro-coagulation is im-

practical unless one can foresee some means of closing the mouth by a subsequent plastic operation. If such a subsequent plastic operation is planned the surgeon who is to do the operation should see the patient and be consulted in advance, before the radiologist attempts the destruction. We have no more right to assume in advance what the surgeon's judgment and procedure will be than the surgeon has a right to assume what will be the judgment and procedure of the radiologist. Both specialties are developing too rapidly for either to take up the other as a side issue, and more will be accomplished by co-operation.

Generally speaking, I believe that in these advanced primary cases a thorough trial should be made first with applications of radium, and if skillfully applied, good results may be expected. In some cases marked temporary improvement only may occur, and a stage is then reached in which the disease is at a standstill or may begin to progress in spite of radiation. At such stage, complete and thorough local destruction or complete surgical excision is probably the only procedure left. With the co-operation of skillful surgeons I have had success in some such advanced cases.

RADIATION

Radiation is indicated in all cancers of the lip, no matter what other treatment is used, and sufficient radiation must be used to actually destroy the cancer cells. If a patient is to be operated upon surgically, a preliminary radiation with a full erythema dose should be given over the lip and chin, and in the submental and submaxillary regions. After the operation, in two

to three weeks after the preliminary treatment, similar radiation should be given. The patient should then be kept under observation for several years, and more radiation should be applied if there is the slightest sign of recurrence. This same sort of radiation should be added to electro-coagulation, and can be applied most practically by means of the roentgen rays. For this purpose I use a nine inch spark gap, with five milliamperes of current, through six mm. of aluminum filter, at a distance of thirty cm. for twenty-five minutes. The time must be governed by the radiation value of the individual instrument used.

If one possesses sufficient radium and sufficient skill in its use, most and perhaps all, local cancers of the lip can be cured by this means. It will require more time, more skill, more patience than by the combination of electro-coagulation and radiation, but there will be more preservation of tissue and a better cosmetic result than can be obtained by any combination with surgery or electro-coagulation. Therefore, I can lay down no rule for the treatment of all cases. The circumstances surrounding the individual case should govern our procedure. Quick was successful in 69.5 per cent with local applications of radium to the primary tumor.

If radium is to be used for the local destruction of the cancer with the preservation of the tissue the local tissues must be kept saturated to the limit of toleration of the normal structures until the cancer entirely disappears.

If one has sufficient radium the submaxillary regions can be treated by surface applications, properly screened,



Figure II.—(a)—Dr. W. J. Dubler's patient. Epithelioma of the lower lip following "fever blister" three years previously. No palpable lymph nodes. Destroyed by electro-coagulation July 15, 1915.
Figure II.—(b)—Healed and apparently well October 27, 1915. Still well November, 1921. Defect not noticeable when mouth is closed.

otherwise the roentgen rays should be used.

If metastatic nodules are palpable they should have preliminary radiation, as above described, and should then be dissected out surgically, or treated by the insertion of radium needles sufficient to destroy the disease.

Radium needles of ten mg. each may be inserted one cm. apart throughout the diseased area, and left in place for eight hours. Following the insertion of radium needles into tissues there is the

production of fibrous nodules (especially when the needles are placed farther apart, and left in place sixteen hours), which are composed of fibrous tissue and result from the necroses produced by the radium. They will lead the untrained to suspect malignant nodules or redevelopment of the disease. With our meager knowledge on this point, it will require considerable skill to be able to distinguish between the disease and the fibrous tissue. Therefore, I urge close observation,

lest a false security may lead one to neglect true malignant disease.

The following conclusions may be drawn:

1. Any fissure or crust on the lip which lasts over a month should lead one to suspect malignancy.

2. Local destruction by electro-coagulation, followed by thorough radiation should cure practically all cases if treated early.

3. Thorough radiation by radium or the roentgen rays should be given over the lymphatics draining the diseased area.

4. Recurrent carcinoma gives very much less satisfactory results.

5. Metastatic lymph nodes should be treated by surface radiation and then by radium implantation or by excision.

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DISCUSSION

DR. WILLIAM ALLEN PUSEY (Chicago): There is not a great deal for me to say, except to express my appreciation of this very excellent paper. In nearly all particulars my experience agrees with Dr. Pfahler's and I can corroborate the views that he has expressed.

In regard to the diagnosis, the importance of early diagnosis in these cases cannot be too much emphasized.

There is one point I do not agree with, and that is the proposition that it is dangerous to take sections from these epitheliomas because of the likelihood of causing more rapid spread of the disease. That has been a bogey with us for a great many years.

Personally, I am thoroughly ready to say that ninety per cent, certainly, of carcinomas of the skin can be as accurately diagnosed by the eye as they can by the help of the eye and microscope. I do not believe we should hesitate to take sections where we please.

I was greatly gratified a few months ago to read of experimental verification of that view. I have forgotten just whose it was, it may have been Dr. Francis Carter Wood's. I believe he is here and he can correct me if it was not. One of the most reliable men

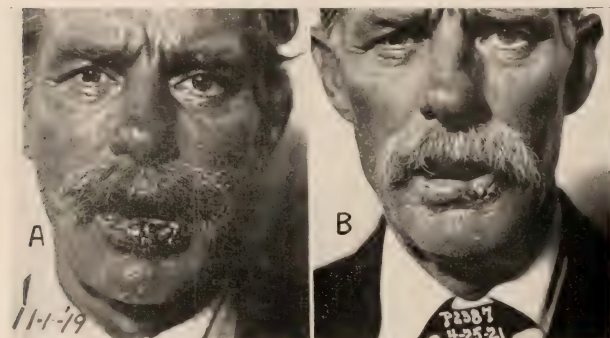


Figure III—(a)—Dr. Chas. Cunningham's patient. Epithelioma of the entire lower lip. Followed an injury by the limb of a tree five years previously. No lymph nodes palpable. Treated by radium because destruction would have involved the loss of the entire lower lip. Figure III—(b)—Treated last on February 3, 1920. Still well November, 1921.

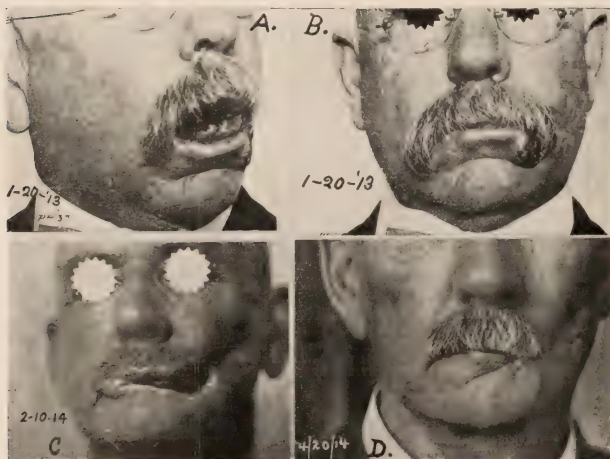


Figure IV—(a) and (b)—Drs. Deemer and Dachtler's patient. Duration twelve years. Had been treated previously by the x-rays. Epithelioma involved two-thirds of the lower lip, one-third of the upper lip, the inside of the cheek to the angle of the jaw. No palpable lymph nodes, probably because of the previous radiation treatment. Destroyed by electro-coagulation January 20, 1913 with application of radium inside the mouth and x-ray treatment over the wound and submaxillary region.

Figure IV—(c)—Showing wound healed after extensive electro-coagulation. Defect was then about one-half of what it was at the time of the destruction.

Figure IV—(d)—April 20, 1914, after closure of the mouth by Dr. Laplace. Still well May 4, 1921, and probably today, eight years after combined treatments.

working in cancer research made a number of experiments on this subject with a large number of controls. He found no more rapid spread in animals from which sections had been taken than he did in the control animals. I would like to call attention to that point and say that my experience does not uphold the view that we should hesitate to take sections from these cases when we please.

As to the treatment of epithelioma of the lip, I believe when you approach that territory you are approaching one of the most dangerous ones for radiotherapy to attack. Personally, I approached it with great trepidation. In my early days in the use of x-ray I formulated the rule that I was willing to treat epitheliomas with x-ray if they were such that a conservative surgeon would not think it necessary to remove contiguous glands. At that time the doctrine was almost universal that epithelioma of the lip meant removal of the glands beneath the jaw. I think my courage to attack epithelioma of the lip was first developed by the fact that some very good surgeons brought members of their families to me to have small epitheliomas of the lip treated with x-ray. I vividly recall a distinguished surgeon bringing his father to me. I thought that was a good precedent. I began to treat superficial epitheliomas of the lip with x-ray and I have done so ever since.

The first thing it established was, to my mind, that there are many epitheliomas of the lip in which the involvement of the associated glands is relatively slow to occur. I do not know how many epitheliomas of the lip I have treated. As I remember, about ten or twelve years ago when I looked over those cases, it was over one hundred. I am sure I have treated several hundred cases of epithelioma of the lip with x-ray. I am not in a position to give the statistics tonight, but my conscience does not hurt me for treating those cases. I feel they have given as good results as could be gotten other ways.

My treatment of epithelioma of the lip has been controlled by a careful selection when I come to deal with operative cases. I prefer to send deep nodular epitheliomas to the surgeon for operation and I want to keep for x-ray treatment only the superficial lesions, I care not how extensive they are.

I have treated many rather deep nodular masses of carcinoma of the lip with x-ray, but in my judgment those cases should have some other form of treatment first—should have radical destruction as far as possible first. Whether this is to be done by electro-coagulation, surgery, or some

other method of destruction is a moot point. I feel it does not make much difference how carcinoma is destroyed so long as it is destroyed. When it comes to electro-coagulation, I am not convinced that it is a method of preference in treating the lip. It seems to me that in extensive cases of lip carcinoma, where the work can be done so thoroughly by operation, that operation may put up strong claims.

I have seen Dr. Clark's work and the work of the essayist this evening in extensive inoperable carcinomas about the mouth. It seems to me that some of their results are marvelous. I believe electro-coagulation has a large field there. In this particular group of cases here, however, I am not convinced that it is more useful than older procedures.

As to the prophylactic use of x-rays, I have never felt inclined to use x-rays preliminary to operation when operation was feasible at the time. I have used x-rays before operation and I can not strongly advocate the preoperative use of x-rays. It seems there is no particular reason for it if you operate quickly, soon afterwards, and that the postoperative treatment covers the ground. I have used postoperative x-ray treatment for carcinoma for over twenty years for a good many of the surgeons. I believe experience thoroughly justifies the procedure.

I believe it applies to the neck and lip as well as to carcinomas of the breast and other carcinomas that can be reached. With these very minor ex-

ceptions, I quite agree with the paper and congratulate the author. (Applause).

DR. EMIL G. BECK (*Chicago*): I suppose that I am expected to discuss this from the standpoint of surgery. Surgery in this class of cases alone would be insufficient. In the face of these illustrations here, I do not see how any body can doubt the value of radium and x-ray in connection with surgery in cases of cancer of the lip.

In a recent meeting in Chicago on the cancer problem where Dr. Maud Slye showed some of her work and I had the chance to show some cases treated by surgery, especially those of the jaw and lip, she made the statement that if she had cancer she would not come to see me. I asked why and she replied that she was afraid I would cure her. The only objection that could be used against these cases is the deformity. Cancer patients do not care if only they live.

In discussing the subject from the practical standpoint of surgery, I will say, as does Dr. Pusey, that it makes very little difference how you destroy the cancer if you follow it up with radiotherapy in order to prevent the recurrence in parts which cannot be reached by the surgeon.

I have no experience, of course, in the coagulation method. I have treated all of my cases with surgery first, leaving the wound open.

DR. C. W. HANFORD: There is a practice common among our leaders, that is the use of an escharotic before

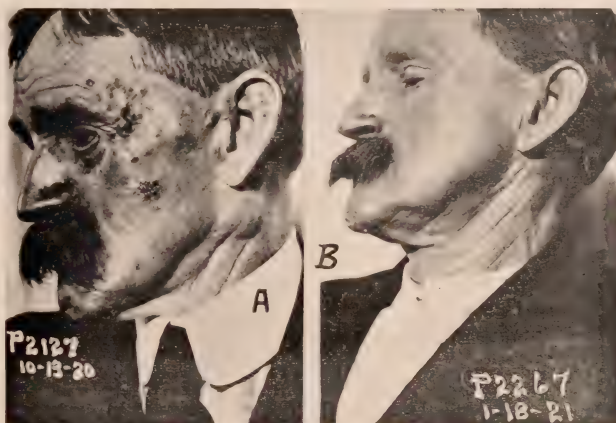


Figure V.—(a)—Dr. Harry Jarrett's patient. Epithelioma in the left temporal region and sides of the face with metastasis from the temporal lesion back of the angle of the jaw. Lesions on the face destroyed by electro-coagulation October 13, 1920, followed by x-ray treatment and eight ten-milligram needles inserted into the metastatic lymph node for five hours, October 12, 1920, and for six and one-half hours November 23, 1921. Figure V.—(b)—Shows complete disappearance of this lymph node January 18, 1921, together with disappearance of the other lesions on the face. There had been no recurrence of this lymph node November 14, 1921.

the patient is sent to a surgeon or roentgenologist or radium therapist. They have so many times attempted to use silver or a little paste with a little carbon dioxide, until finally, when the patient comes before the roentgenologist the tissue is so devitalized that it is a question whether we want to do anything or not. I think we should be as chary against the use of these escharotics in the case of epitheliomas as we would be of a rattlesnake.

As regards the nose, we find that the needles placed in the nose seem to answer all requirements. We find four to five hundred milligram hours in a nose the size of a small English walnut is sufficient to cause cryptic change. If you take that out you will find no carcinoma.

There is another point I want to speak of and that is cleanliness. It is a foul habit for the patient to be continually licking the tongue after radiation. He may undo many efforts there. It is my practice to have them wear continually a piece of gauze or several thicknesses saturated in boric acid solution and these are changed every hour. For the mouth particularly they should carry a package of gauze and change this every hour. Better results will come if that cleanliness is observed. At the Cook County Hospital we are trying out diathermials. We hope to get our technique to the point where we can prepare a surface for radium and get

results in cases that now go down to the grave. (Applause).

DR. C. M. McKENNA: What anesthesia, if any, do you use? It seems that Dr. Pfahler brought out an important point when he said he could tell how much destruction would take place by using the radium. It seems to me that he further brought out a point that the man doing that work should do it alone and it could not be used as a side issue.

While I am not doing lip surgery, I have had chances to see bladder cases where we used radium and had a considerable amount of contraction afterwards, due to the destruction in the bladder outside the diseased part. That is an important point and one that a man using radium or x-ray should know.

DR. PFAHLER: I would like to thank the gentlemen very much for their discussion. First, Dr. Pusey's criticism about the removal of a section. It requires very little more traumatism or deformity to destroy the growth and if it were on my lip I would rather have it off than merely know what it is. (Applause).

Now, with regard to the ante-operative treatment, if I were to limit my treatment to one of two applications, either one immediately before or one immediately after, I would want the treatment immediately before, because by this means we devitalize those carcinoma cells so they have less power of

being transplanted into the open wound. That is not guess work—it has been worked out scientifically and experimentally.

I have not the names in my mind at the present time, but, for instance, one of the experiments that was carried out along this line consisted in taking a series of mice with rat sarcoma. That gave a definite and uniform order of reproduction. A tumor was treated, then half of the tumor was taken out and inoculated into some other rats. The other half was treated by the rays *in situ*. It was taken out, inoculated into a corresponding group of rats. The second sarcoma did not have any takes. You will find that work reported by Colwell and Russ. There is a great deal of work being done along this line. I consider the ante-operative treatment the most important.

With regard to anesthesia, if the lesion is small, such as the group we like to get, I inject the lower lip with novocain, keeping the point of injection well beyond the diseased area and destroy it by means of electric coagulation. I have had no bad results of any kind. If it is a large case, that is, a case with large lesions, general ether anesthesia must be used. If you use ether you must be very careful to remove your ether completely from the patient before you attempt to do this destruction or you will have an explosion.

Duodenal Bulb Deformity in Relation to Symptoms and the Chemistry of the Gastric Juice*

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DUODENAL bulb deformity outranks every other x-ray sign of duodenal ulcer. The serial method which the genius of Lewis Gregory Cole has brought into universal recognition makes the demonstration of this sign more certain than surgical exploration. It is acknowledged that bulb deformity may have other causes than duodenal ulcer and that duodenal ulcer may be present in a bulb of normal contour, but in actual practice it is apparent that the roentgen diagnosis of duodenal ulcer hangs upon this single sign.

The accessory roentgen signs of duodenal ulcer are relatively indecisive. The rapid expulsion of the barium meal may be taken to substantiate the bulb deformity, or, again, a six hour residue may be interpreted to do the same ser-

vise. A type and tone of gastric peristalsis may be called characteristic, but again in certain cases a gastrosplasm is equally convincing. The localization of a pressure-pain in the bulbar region ignores the gall-bladder on one side and the head of the pancreas on the other. Moreover, an epigastric pressure-pain may not uncommonly be elicited without a pathologic basis of any kind. In short, the bulb deformity is seen to stand back of every other roentgen sign of this disease.

Notwithstanding the dominance of this sign it is not alone a sufficient basis for a diagnosis. Adhesions and reflex spasm from neighborhood diseases are rare but demonstrated causes of persistent bulb distortion. The greatest error comes in borderline deformities, where the bulb is not normal and yet not definitely deformed; often it is either too small or conspicuously large or again it shows a diverticulum, which

may be either congenital or a result of ulcer. Not all cases are clear cut and convincing. It is desirable, therefore, to have some diagnostic support from quite a different source.

Such support stands ready in the history of the case and the chemistry of the gastric juice. It will be objected at once that this is the province of the internist, not of the roentgenologist. It is my cherished conviction that the roentgenologist who voluntarily cuts himself off from the history of the case, the physical examination and the laboratory findings, sacrifices the professional status with which his medical education endows him and instead of assuming the standing of a consultant, rates himself as a technician. It is his right and privilege to ask for the clinical records in order to make better and wider interpretations of his roentgen findings. In all cases of suspected duodenal ulcer, whether or not there is a

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distinctive and persistent bulb deformity, he should carefully consider the symptoms and the chemistry of the gastric juice before translating his roentgen findings into the terms of a clinical diagnosis.

I am but repeating and emphasizing what many other workers advocate. Carman in his "Roentgen Diagnosis of Diseases of the Alimentary Canal" gives one of the best resumes of the symptoms of duodenal ulcer that can be found. He also provides a place on his roentgen record sheets for the examination of the stomach contents. Holzknecht included the hydrochloric acid percentage in his symptom complexes, where the signs and symptoms were cut to the irreducible minimum.

In order to examine the value of such methods I have reviewed a portion of our own work of the last five years. During this time the stomach contents have been examined in our laboratory in approximately one thousand cases which have made complaints of digestive symptoms of some kind. This number is of course small in comparison with cases passing through great hospitals and clinics. Their chief value lies in the care and completeness with which each case has been examined. The work has been carried out as a part of daily practice in conjunction with my associate, Doctor, John B. Jackson, and the help of several very capable assistants. The records include the history, the physical examination, the x-ray examination and the laboratory analysis of the blood, urine, stomach contents and such other material as may be obtained.

The general percentages represent, we believe, a fair average of cases as they occur in towns under fifty thousand surrounded by an agricultural population. Statistics at best are but approximations. City hospitals represent various grades of unavoidable selections. Sanitoria attract the wealthy. Charity or county hospitals receive cases that have been subjected to the influences of poverty, ignorance, filth and neglect. The statistics given in this paper represent a cross section of the average American population living under fairly favorable conditions outside of large cities.

In most cases the stomach contents have been obtained by the Rehfuess method. Five or six samples are taken at fifteen minute intervals during the process of digestion, beginning one-half hour after the Ewald test meal. This fractional method, with a varying acidity in each sample, makes possible a comparison of cases by means of the acid curves.

Four types of curves are seen: first, a regular half-moon form with the height of the acid curve in the middle sample; second, an ascending curve with the height in the final sample; third, a descending curve with a high initial acidity; fourth, a sustained curve with a high initial acidity, which is maintained throughout digestion. These curves bear a closer relationship to symptoms than to bulb deformity, but yet seem not without significance.

Of our one hundred and twenty-six cases in which duodenal ulcer was diagnosed we constructed acid curves in ninety-four. Of these, forty-nine showed an ascending curve, twenty-four a sustained curve, sixteen a regular curve, and only five an initial hyperacidity with a descending curve. The ascending hyperacidities showed the most uniform concurrence of an ulcer symptomatology with a persistent bulb deformity. The sustained curves, however, were of no less importance, as seen by operative results. Of the twenty-five cases operated upon in this series, eight showed the sustained hyperacidity and in every one ulcer was found; also eight showed an ascending type of curve, and in three ulcer was not found. In two of these cases the duodenum was not explored because of the patient's request, only the appendix being removed. In the other case, the concurrence of a pronounced hyperacidity, a clear ulcer history and persistent deformity of the bulb made us unwilling to accept the operative findings as final. We would, therefore, look upon these two types of acid curve as of equal significance, and when existing in a case of doubtful deformity of the bulb would incline the diagnosis in favor of ulcer.

Of the one thousand cases of gastric analyses, four hundred and thirteen showed a hyperacidity and one hundred and nineteen showed achylia, or a total absence of free hydrochloric acid. Duodenal ulcer was diagnosed in one hundred and twenty-six, gastric ulcer in twenty-six, gastric cancer in twenty-eight, and duodenal cancer in one. Duodenal ulcer below the bulb was found twice. Duodenal ulcer was thus diagnosed more than twice as often as all other organic diseases of the stomach and duodenum combined, but less than thirteen per cent of all cases coming in with digestive symptoms showed duodenal ulcer.

As previously stated, these cases were studied by both x-ray and clinical methods. Much attention has been paid to the taking of histories. For our medical forefathers, the history of the case was almost the sole foundation for

diagnosis of peptic ulcer. The physical examination added little, often nothing, except in cases of perforation and hemorrhage. The localization of a pressure-pain was very misleading then, as now. Moynihan's dictum was, "history everything, physical examination nothing." It is true that in no other organic disease is so brief a history so convincing. Epigastric pain relieved temporarily by eating or by an alkali is the pivotal fact. In some cases, vomiting, hematemesis, nausea, and regurgitation are to be added. Constipation is the rule. The fine art of taking histories requires correlation of isolated facts, and a keen insight, which is a mixture of temperament and experience—therefore, a history is largely an individual matter and can never be of equal value to all examiners. A history alone has irreparable shortcomings at the best. This is clearly revealed by the case records of pre-roentgen days when gastric ulcer was believed to be relatively common and duodenal ulcer exceedingly rare. The x-ray and operative findings have shown that the opposite is the truth. Granted that a history is an untrustworthy guide to the localization of ulcer, it is notwithstanding, the fundamental document of diagnosis to which laboratory analysis and the roentgen findings are but contributions.

In our records of one hundred and twenty-six cases of duodenal ulcer an ulcer symptomatology was found in all but nine cases. When these nine were studied six were found without hyperacidity. The three which had hyperacidity with bulb deformities submitted to laparotomy. One showed a general carcinomatosis, one a cancer of the liver, and one a cholecystitis with gall stones. Of the four which showed no hyperacidity, ulcer was found in two, no ulcer in one, and one remained without operation. If conclusions are allowable from such limited data, we would say that in the absence of hyperacidity symptoms may not be produced even though ulcer is present in the bulb, and that in cases with hyperacidity and with bulb deformity the absence of ulcer symptoms is strongly suggestive of some other abdominal disease.

A history suggestive of ulcer may be found occasionally in cases of achylia. In the literature many duodenal and gastric ulcers have been reported with a total lack of free hydrochloric acid. In the present series one hundred and nineteen cases of achylia are recorded. In not one were we able to make a diagnosis of ulcer and no ulcer has since been found in any one of these cases. However, twelve of our cases of duodenal ulcer showed a total lack

of hydrochloric acid in one or two samples of the five fractions of the stomach contents, but in five of these twelve cases there was a well marked hyperacidity in the final fractions, while in the seven remaining there was a final normal acidity. If a single sample had been relied upon for the gastric analysis these patients might have been rated as cases of achylia. Inasmuch as ulcers may be latent or without symptoms, usually in the absence of a hyperacidity, the presence of a history suggestive of ulcer in a case of achylia would lead us to look for other pathology than duodenal ulcer.

Gastric peristalsis in achylia is deep and vigorous and the expulsion of the barium very rapid, thus exactly simulating duodenal ulcer. Gastric analysis is therefore very important. The bulb fills especially well in a case of achylia and is as a rule large and of the typical pyramidal form. But in cases of doubtful bulbus the gastric analysis may be the decisive factor in diagnosis.

The frequency of diverticula of the duodenum in ulcer exceeded our expectations. In one hundred and twenty-six cases thirteen were found. When originating in the bulb they are difficult to distinguish from true bulbar deformities. When a positive history and hyperacidity are both present such cases must be placed in the ulcer class, although diverticulitis may be a more correct diagnosis.

Chronic appendicitis and cholecystitis, with or without gall stones, are frequent causes of mistaken diagnosis. I believe that an irritable appendix may cause an incision of the bulb. It is well known that adhesions to the gall-bladder are causes of pseudo-bulbar deformities. A good history is nowhere of greater value than in such cases.

Operation was performed on only twenty-five of the one hundred and twenty-six ulcer cases, although surgical treatment was advised in many more. The answers to follow-up letters show that the reason for this is the prompt and satisfactory recovery under the alkaline treatment as advised and practiced by Dr. Sippy. Of these twenty-five operated cases ulcer was found in nineteen. In two cases, at the request of the patient, the duodenum was not explored, but only the appendix removed. In four cases the surgeon failed to find ulcer. In justice to the roentgenologist it may be said that duodenal ulcers are often found with great difficulty, even by experienced surgeons. When the roentgenologist can attend the operation the advantage is mutual, but outside of institutions this cannot always be done.

Of the four operated cases in which ulcer was not found three showed a persistent bulb deformity. In one, however, a good ulcer history and a hyperacidity were lacking. Also one gave a good ulcer history and a hyperacidity, but showed a normal bulb. A sound diagnosis should show all three factors, namely, ulcer history, hyperacidity, and bulb deformity.

In conclusion, we would urge the use of clinical records before x-ray interpretations are made, first, because that procedure minimizes errors, especially those of omission, and second, because it preserves the professional status of the roentgenologist.

DISCUSSION

DR. E. W. ROWE (*Lincoln Neb.*): It may be like carrying coals to Newcastle to discuss the papers of the morning, especially since I wish to confine my remarks to the diagnosis of gastric and duodenal ulcer.

I am going to report, probably, some well known points. It is of value to emphasize these points because they are valuable points.

Statistics often may be twisted so they are not worth much, but nevertheless the size and importance of the field of the roentgen diagnosis of duodenal ulcer has hardly been appreciated.

A summary of fifty-nine thousand autopsies published by Dr. Easton shows gastric and duodenal ulcers incident in four per cent of these.

I want to call your attention to the increase in accuracy of diagnosis since a few years ago when twenty per cent was the accuracy of diagnosis. Today, with combined methods, it is practically one hundred per cent.

This is the point I wish to make from this: The work of the roentgenologist has not only increased the accuracy, but it has stimulated the clinician so that he also has increased his percentage of accuracy.

Little has been said about fluoroscopy versus the roentgenogram. I think fluoroscopy is not sufficient for the average worker. The roentgenogram combined with the fluoroscopy is of great importance to the average man. The roentgenogram gives a series of different phases of motor activity. I wish to call your attention to the fact that we are still in the transition period of method of diagnosis. There are still some who are plotting beautiful curves that only a physiologist can understand and they are making accurate deductions from those curves. In the hands of a man like Dr. Sippy, such a method may be of high value. In the hands of Dr. Carman, x-ray alone shows a value of almost ninety-eight per cent, but for the average man, these

methods must be combined or the per cent will not be nearly so high.

I wish to call your attention to the fact that the negative diagnosis of gastric and duodenal ulcer is of vast importance. Exploratory operation is often permissible, is often right, but exploratory operation tends to be used less and less as accuracy of diagnosis increases; when exploratory operation is done, it is simply a frank, usually an honest, admission of inaccuracy or fallibility of diagnosis.

Every gastric or duodenal ulcer known to exist should be studied at least once a year, not to determine whether it is present especially, but to determine the condition of the type of ulcer, for upon the diagnosis or the determination of the type of ulcer depends the method of procedure.

In the diagnosis of all troubles in which there is more than one valuable diagnostic point, we must keep in mind the relative importance of these points. Too often we are lost, not being able to keep in mind the relative value of points. I am reminded of a homely expression of Dr. Mayo, which I have heard him repeat a number of times, namely, that there are ten dollar bills in diagnosis and there are five cent pieces in diagnosis. Of course, the ten dollar bill in diagnosis of duodenal ulcer is the deformity. There are many points which might be called five cent pieces. (Applause.)

DR. MILTON M. PORTIS (*Chicago*): It is possible to touch only briefly upon the points of these very excellent papers to which it has been my privilege to listen this morning.

Dr. Crane, in his usual characteristic, clear way has brought home to you again the fact that medicine covers all fields. None of us is an entity. We must work together in harmony and must give to the patient our combined advice.

It is the atypical case that Dr. Crane is talking of. Dr. Carman showed you an error of five per cent in his work. We are not yet at the stage where we can make one hundred per cent diagnoses.

There is one thing in Dr. Crane's paper that I wish to emphasize. I will admit that gastric analysis is worth very little in the diagnosis of duodenal ulcer if by stomach analysis is meant giving the patient tea and toast, which is then pumped out in thirty, forty, or fifty minutes and the laboratory findings on this content used as the basis of evidence. If with your ordinary test meal you get a proper return of high acid readings, accept the report. If the readings are low or the acid is absent you must do a fractional meal. You

are not privileged to draw conclusions without doing this.

We are accustomed to give every patient a motor meal. That precedes the gastric analysis for the ordinary Ewald test. With these meals we find a delayed emptying time of the stomach which the x-ray does not show. I remember a patient that Dr. Case showed. We reported a five hour

emptying time. When we gave the barium with the regular meal the stomach did not empty for eight or nine hours—a case of duodenal ulcer.

A word about the operative confirmation of some of these cases. You remember, from the evidence at the Mayo Clinic, that some of these ulcers are very small and very difficult to see even when the duodenum is opened.

Negative diagnosis made by the surgeon after putting the hand in the abdomen, feeling it, often without exposing it, makes no appeal to me. If there is definite roentgen evidence of duodenal ulcer I think it is worth while to insist that the duodenum be opened up and properly explored before the surgeon decides that ulcer is not present. It is frequently there when he says it is not.

Study of Hilus Pneumonias by Serial Radiographic Examination

L. R. SANTE, M. D.

From the X-Ray Departments of City Hospitals, Nos. 1 and 2
St. Louis, Mo.

THE recent influenza epidemic served to call the subject of atypical pneumonias to the attention of the medical profession. Serial radiographic examinations of these pneumonias, taken at intervals of from one to three days, revealed some very interesting data as to the modes of invasion, cause, and prognosis of the disease. While some of these types of pneumonias were familiar to the roentgenologist others had never been encountered before. To determine whether these types of pneumonia were peculiar to the influenza epidemic a closer observation was made of pneumonia cases occurring since the epidemic and serial radiographic examinations were made in all cases in which any atypical variety was found.

One particular type of pneumonia seen during the influenza epidemic⁽¹⁾ consisted of a consolidation limited to the hilus region. To some of these cases which proved very fatal the name of "critical pneumonia" was given by Ewing. The pathology in these cases was described as a zone of hemorrhage and pus completely ensheathing the bronchi in the hilus region and sweeping out to the periphery, choking off the patient's air supply. In others, after a very brief period, the temperature fell to normal by crisis, the patient having presented typical pneumonia symptoms, but few if any physical signs distinctive of pneumonia.

Among two hundred and seventy-six cases of primary pneumonia treated at City Hospitals, Nos. 1 and 2, during the past year, twelve such cases were found. None of the cases was in connection with the influenza epidemic and none of those reported occurred within one year of the last outbreak. The ages of these patients varied from twelve to sixty-two years. Although the two youngest patients were both twelve years of age, no other case was encountered under twenty-seven years of age, and the greatest number were over thirty years old. In practically

all instances the disease followed exposure to cold, swimming, etc., and was preceded by a cough. A definite chill or chilly sensations marked the onset of all the cases. This was followed by a fever of continuous type and the temperature generally reached a rather high degree, attaining 105.8 in one case. The duration was from four to ten days, and in all but one case deferescence was by crisis. Pain in the chest was frequently encountered, but was inclined to be a dull ache in the middle of the chest or between the shoulders posteriorly rather than the sharp pain of pleurisy. In some cases, pain on pressure over the interscapular area was elicited. The sputum was bloody at some time during the disease in all cases, sometimes transitory, lasting only for a day, but at some time or other the sputum was blood tinged. The sputum was not a "prune juice" type in a single instance. The leukocyte count was usually high, from 16,600 to as high as 33,000. The only particular feature which was present in all cases was the almost total lack of dis-

tinctive physical signs. The patient, presenting an unmistakable picture of a pneumonia, was seen to continue day after day without appreciable physical signs. Occasionally there were a few rales posterior between the scapula and vertebral column, and in some cases sensitiveness to pressure over this area, but there was no change in percussion noted and no bronchial breathing. The rapid fall of the temperature to normal without development of physical findings might lead one to believe that the diagnosis of la grippe is often made.

This may also explain the small number of hilus pneumonias reported to have occurred in this large number of pneumonia cases; hidden under the diagnosis of la grippe, the cases were never submitted for radiographic examination.

In those cases in which radiographic examinations were obtained a sufficiently constant picture was presented to warrant description. Radiographic findings in these cases can be best outlined by separate consideration of the different types of consolidation en-

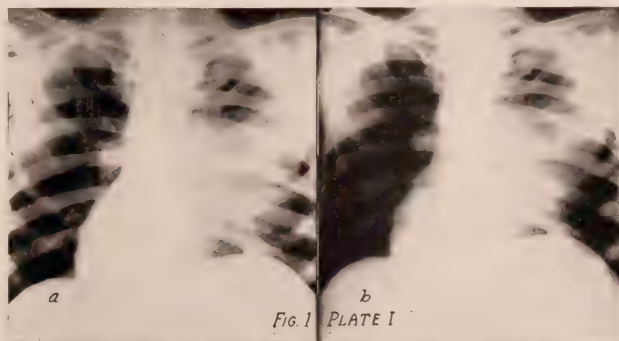


Figure 1.—(a)—Plate I—Acute inflammatory type of hilus pneumonia in an adult showing the most extensive involvement attained during the course of the disease. (b)—Plate I.—A few days after crisis. The consolidated area resolves more by a shrinkage in size than by a decrease in density of the shadow.

countered and by a notation as to the age of the patients in whom they occurred, whether adults or children.

In the acute inflammatory type a consolidated area was noted in the hilus region on one side or the other (Fig. 1). The incidence of occurrence was about equally divided on the two sides, but in no case was a doubled hilus consolidation encountered. The consolidated area was well defined in the hilus region and extended outward into the lung. It was dense and showed little tendency to spread peripherally as the disease progressed. It was usually found to be as large within twenty-four hours after the onset of the disease as it ever became, and, in fact, at the first examination the area involved represented practically the most extensive anatomical advancement which the disease attained. It was not accompanied by a general haze over any particular lobe such as is often the picture encountered at the onset of a lobar pneumonia, and it was rarely associated with

pleurisy or thickening of the pleura. In these respects it can usually be differentiated from lobar pneumonia, even when a single radiographic examination shows only a hilus consolidation with no accompanying haziness of the remainder of the lobe. Such consolidations do not remain confined to the hilus and rapidly extend to and involve an entire lobe of the lung. This condition does not pertain to hilus pneumonia, however. Under these circumstances some difficulty might be experienced from a single radiographic examination in differentiating the two conditions. Re-examination after twenty-four hours should always determine the character of the condition. No change can be noted in the consolidated area for a few days after the crisis, and resolution takes place more by a gradual shrinkage of the area involved than by a progressive decrease in the density of the shadow. From the character of the lesion and the course of the disease it is quite evident that these cases were

pneumonias of inflammatory origin. One was in a child (Fig. 2), the others in adults. In all the cases of this series resolution was complete within two weeks after the crisis.

A second type of consolidation was encountered, very similar in radiographic characteristics, but more protracted in its course and associated with milder constitutional symptoms (Fig. 3). In this but little change was seen in the hilus shadow over a period of three months. An examination three weeks after the onset of the condition showed some decrease in the size of the shadow. Re-examination three months later, however, showed little change in the shadow from that seen at first examination. In this patient there was never high temperature, nor were there acute symptoms such as were encountered in the other cases. This case was in a boy twelve years of age and conforms to the cases described in the literature as recurrent tuberculous hilus pneumonia of children. This will be referred to later.

That this type of pneumonia existed long before the influenza epidemic there seems little doubt. It was probably in reference to this condition that Osler⁽²⁾ said: "I saw in 1898, with Drs. H. Adler and Chew, a young thin-chested girl in whom at the end of the fourth day all the usual symptoms of pneumonia were present without any pathological signs other than a few clicking rales at the left apex behind. The general features of pneumonia continued and the crisis occurred on the seventh day." Considerable mention is made in the literature of central pneumonia⁽³⁾ and every one with any degree of clinical experience has encountered pneumonia cases in which there was a delay in development of physical signs or an entire absence of adequate findings. Little mention is made, however, of the radiographic findings in these cases. Hilus consolidations are mentioned as occurring in children and it seems to be quite generally accepted that these are due to tuberculous origin. Sluka⁽⁴⁾ and Eisler⁽⁵⁾ have noted such consolidations in young children in association with cough and afternoon temperature extending over a period of months. Two similar cases have been reported by Greenberg⁽⁶⁾ in children under two years of age. A recurrent hilus consolidation has been observed in children by Wessler and Bass⁽⁷⁾ and Sluka⁽⁸⁾ has reported twenty-one additional cases of this type (in his second report, thirty-eight in all) occurring within a period of less than two years. He does not state, however, that all of these cases were of the recurrent type, but does not question their

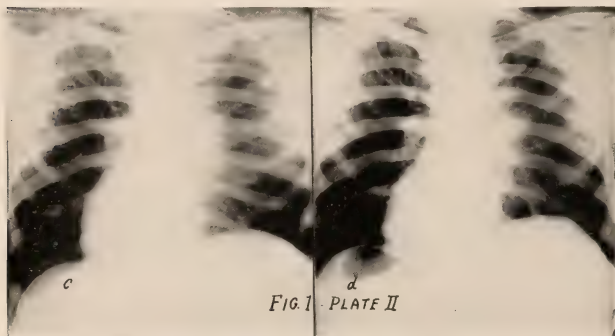


Figure I.—(c)—Plate II.—Resolution continues favorably. (d)—Plate II. —Within two weeks resolution is practically complete.

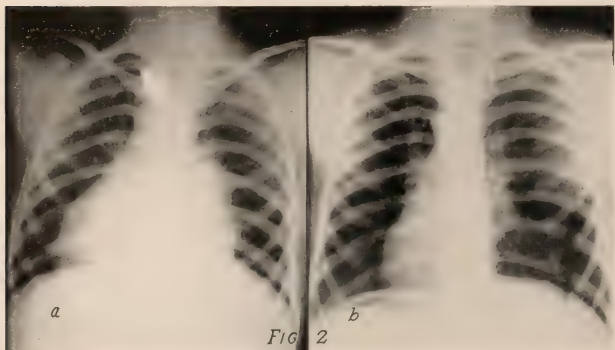


Figure II.—(a)—Acute inflammatory type of hilus pneumonia in a child twelve years of age; shows the most extensive involvement attained during the course of the disease. (b)—Complete resolution occurred within two weeks. Nothing to indicate a coexisting tuberculous lesion was found in the chest.

tuberculous origin. One of our series, previously mentioned, was of this type, showing very little variation in the extent of hilus consolidation over a three months period.

The mere persistence of a lesion over a period of months, does not, in my mind, establish it as tuberculous; in fact, the co-existence of tubercle bacilli in the sputum in a certain percentage of these cases would not be sufficient to establish the cause of the consolidation as tuberculous. The very fact of the ultimate resolution of the consolidated area, even if this does require months in some instances, is an argument against the tuberculous nature of the process. Lung puncture, although it would seem rather dangerous in the hilus area, has been performed in two instances where this condition existed, and was reported by Greenberg⁽⁶⁾ to have yielded tubercle bacilli in one instance and, upon guinea pig inoculation, positive tuberculous findings in the other. This is, of course, evidence in favor of the tuberculous etiology, yet it cannot be considered as sufficient to establish the cause of the consolidation as being definitely due to tuberculous. The question arises as to just what percentage of positive tuberculous findings would result if lung punctures were performed and material extracted from enlarged lymph nodes in the hilus region in patients not suffering from hilus pneumonia. The instances of co-existing evidence of tuberculosis elsewhere in the lung in our series of cases, after complete resolution, were relatively few, only four showing what would be considered evidence of incipient pulmonary lesions. In no case was actual consolidation present. Some mention is made of the possible inflammatory nature of even the protracted type of consolidation. Brandlier and Roepeke

⁽⁷⁾ express some doubt about the tuberculous nature of these consolidations in children, but offer the explanation that they may be inflammatory reactions following the breaking down of old tuberculous lymphatic glands in the hilus. They explain the recurrent type of involvement as a succession of such reactions. While the predominating lesion in childhood may be one which is not rapidly resolved, the fact that hilus pneumonia can occur in children without question of tuberculous involvement, is evidenced by one of our juvenile cases in which an acute pneumonia was present, ending by crisis, and in which resolution was ultimately complete.

Aside from its mention in connection with influenza-pneumonias little has been said of hilus pneumonia in adults (Figs. 4 and 5). With the exception of our two youngest cases, both of which were twelve years old, the others were all over twenty-seven years of age, the oldest in the series being sixty-two. All of the adult cases likewise showed characteristic symptoms, which together with the brief course and rapid resolution, would be indicative of pneumonia of inflammatory origin. Of the juvenile cases, one was distinctly of the inflammatory type, the other of questionable tuberculous variety. The delay in resolution seen in the latter case does not preclude a possible inflammatory etiology. This has been clearly demonstrated by reports of cases of lobar pneumonia where there was a delay in resolution seen in the radiograph for a considerable period⁽⁴⁾⁽⁵⁾ and where final restoration to normal occurred without abscess formation or other pathological lesion. With regard to the inference that these consolidations are the result of inflammatory products thrown into the hilus region as a result

of the breaking down of old tuberculous lesions, would it seem logical to suppose that such an extensive inflammatory lesion might be provoked in the hilus region by the setting free of tuberculous material when it does not cause such reaction elsewhere in the body? In view of the fact that in the large majority of these cases, even in those occurring in children and supposed to be of tuberculous nature, resolution is ultimately complete, is it not more logical to suppose that the primary lesion is a pneumonic consolidation of the hilus of inflammatory origin, that it runs its course and resolves in the majority of instances, and that, in the few remaining cases where interfered with, this is due to the activation of old tuberculous lesions previously existing at this hilus?

In substantiation of this supposition may I cite one case (Fig. 6) not included in this series, which occurred in our experience. In this case the patient, an adult, developed hilus pneumonia while employed in the hospital. The disease progressed favorably, crisis occurred, and in about one week she was permitted to be up and about. Five days after she was allowed to be up, she developed an afternoon temperature, and the radiographic examination at that time revealed a small rarified area within the persistent hilus consolidation. At first the rarified area was thought to be a beginning abscess, but its rapid enlargement from one-half inch to four inches in diameter within two weeks, together with the absence of excessive expectoration or presence of fluid within the area at any examination, renders this doubtful. It was thought possible that there was a cavity in the interstitial tissue of the hilus rather than in the lung substance, caused by the breaking down of an old

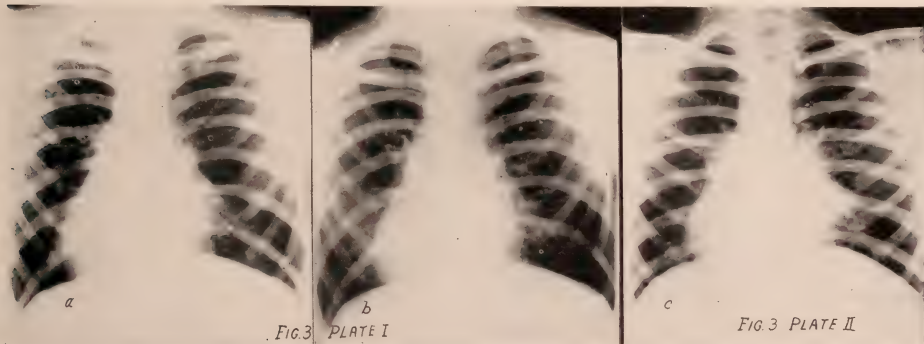


Figure III.—(a)—Plate I.—Protracted type of hilus pneumonia in a child—so-called tuberculous type, showing original consolidation. (b)—Plate I.—Some slight decrease in the hilus consolidation was noted three weeks later. Figure III.—(c)—Plate II.—Examination after three months, however, showed a very extensive involvement of the hilus still present.

tuberculous lymph node. Tubercle bacilli were found in the sputum and the pathological condition in the lung showed little if any change over several months observation. Gradual retraction of the area occurred until in an examination made one year later, for which I am indebted to Dr. H. E. Kessler, a small, well walled off area in the hilus region was all that remained. This may explain similar shadows seen in the hilus region in other individuals, years after the acute process has healed. We have encountered one such case in which there was a history of pneumonia and protracted recovery.

In short, a pneumonic process of inflammatory type may involve the hilus region in either children or adults. Such involvement may terminate in complete and rapid restoration to normal in either case. Where a previous tuberculous process is present in the hilus, the inflammatory reaction may be sufficient to activate the old quiescent lesion.

The difference in the nature of the reaction to such an activated tuberculous lesion in adults and children may be due to the predominating characteristics of tuberculous lesions of the hilus at different ages. In children the less confined character of a tuberculous lesion produces a more diffuse reaction, while in adults the heavy barrier of fibrous tissue about the lymphatics and the caseous lymph glands offers a better field for local disintegration and cavity formation.

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DISCUSSION

DR. STEWART (*New York*): I was particularly interested in Dr. Sante's presentation. About five years ago I published an article describing the differential diagnosis of pleuritic effusion and pneumonias in children. I described three forms of pneumonia. Dr. Sante calls it hilus pneumonia. I called it a root pneumonia. There are certainly three distinct classes—ordinary lobar, so-called root pneumonia and bronchial pneumonia.

In the lobar pneumonia, or cortical pneumonia, the process always commences at the pleural surface. It assumes a triangular form working towards the root with the apex at that point when the full consolidation is reached.

The difficulty with physical signs during the period of the extent of the pneumonia from the pleural surface to the root is quite evident, and I make the assertion that in many cases of pleural pneumonia roentgenologists could make a diagnosis at least three days before the physical side is apparent.

I make this on the basis that it is due entirely to the break in the sounds carried from the solid area to the larger bronchi in which it has to pass from a solid section into a well aerated section before it reaches the bronchi. As soon as the consolidation reaches the apex of the root, bronchial breathing is heard.

Dr. Sante's experience with root pneumonia is a little different than mine. The reverse is the case of a statement I have just made, because with the consolidation at the root, the sounds are conveyed almost immediately, and at

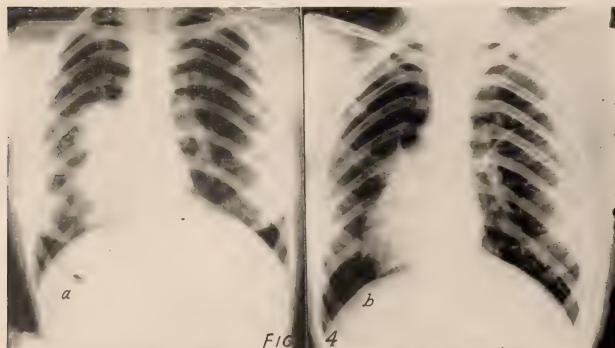


Figure IV.—(a)—Acute inflammatory type of hilus pneumonia in an adult. Radiograph, made within a few hours after the initial chill, shows that the maximum extent of the consolidation is attained within a short time. (b)—Complete resolution within two weeks.

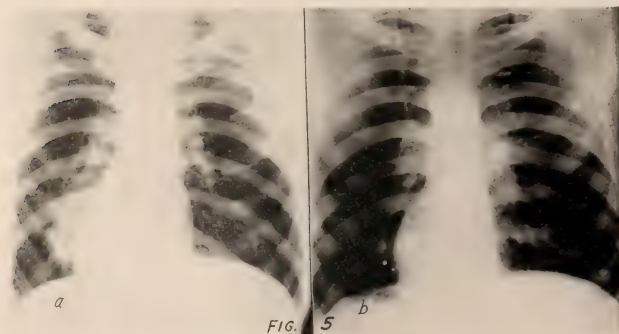


Figure V.—(a)—Acute inflammatory type of hilus pneumonia in an adult, showing a somewhat different appearance in the character of the hilus consolidation. (b)—Resolution complete within two weeks.

least my experience with the men with whom I am associated is that they have been able to recognize the process very early.

It is this form of pneumonia that is called a four-day pneumonia. If you have had experience with children, clinically, you will know there is a class called a four-day pneumonia in which resolution occurs very early. This is the process that occurs at the root involving more than one lobe. In result it is very interesting, particularly postoperative cases. Many cases are referred to you that have undergone a surgical operation. On the fourth day there is a sudden rise of temperature, many signs of consolidation of the lung and upon roentgen examination you fail to find any evidence of a pneumonic process.

If you will bear in mind that most of these cases are root cases and look carefully at your hilus, in many instances you will find the cause of the trouble.

Dr. Sante's case where he showed an apparent increase in the size of the cavity is most interesting. It seems rather rapid to be an abscess. I am more inclined to believe it is a pleural effect. I would like to ask the doctor if the studies were made stereoscopically? Perhaps that would enlighten us.

It brings up a most interesting subject, and that is the value of the lateral position in the examination of the lung, particularly in those acute processes. I wish those who are doing much lung work would take advantage of the lateral position. You would be perfectly surprised to see the difference in the size of the cavities in lung abscesses as they appear in the lateral and in the erect.

I mean by the lateral position that the patient lies on the side, the tube is placed at the back and the tube is placed in front. Only recently I had a case of that character in which there was demonstrated a very marked movement of the entire mediastinal contents. I took the matter up with Woolmeyer and he seemed as much surprised as I did as to the visible evidence of a movement, a mediastinal movement or movement of the contents of the mediastinum to the opposite side.

DR. RICHARDS: I just wanted to ask the doctor if he has done any work on the treatment of these central pneumonias. I want to ask Dr. Sante that.

DR. SANTE: Mr. Chairman and Gentlemen: To Dr. Stewart's remarks, I would say that only two of our cases were in children. One was of the supposed tuberculous type, one of the inflammatory type. That of the inflammatory type lasted ten days. In

neither case were there distinctive physical signs. Most of the cases were adults. There was slight tenderness on pressure between the scapula and the vertebral column on that side, possibly a few clicking rales (I am accepting the statements of the clinician that had the case) no definite dullness from consolidation, no blowing breathing, nothing distinctive of pneumonia.

The average duration of these adult cases was seven days. None of these cases occurred after operation or in complication with any other disease. I made it a point to exclude all of these cases.

With reference to the annular ring, I would say that the first three or four sets of plates were made stereoscopically. The others were simply flat plates. Dr. Kessler's, taken six months and a year later, and made stereoscopically, showed the annular ring to be in the hilus region, not at the periphery.

There was one thing about tubercu-

losis in children. We have quite a number of children at the Cook Hospital for Tuberculosis in St. Louis. I may say that while, of course, I realize that it is the exception, still we have several children there with massive involvement of an entire lung with cavity formation, some of whom have had tubercle bacilli in the sputum for two and a half years. I refer to children five and six years old.

With reference to Dr. Richard's statement as to treatment, of course, I assume he means medical treatment. They get well by themselves. Resolve within ten days and get all right.

DR. RICHARDS: I mean x-ray treatment of chronic pneumonia.

DR. SANTE: No, we have not, mainly because we have not been able to control them. We were not able to get a single case back for further examination after three months. If the patient feels all right he won't come back.



Figure VI.—(a)—Plate I.—Acute inflammatory type of hilus pneumonia in an adult, with complications, showing a small rarefied area within the persistent hilus consolidation. About two weeks after crisis. (b)—Plate I.—Radiograph taken six days later. The rarefied area continues to enlarge



Figure VI.—(c)—Plate II.—This rarefied area enlarged from one-half to four inches in diameter within two weeks. This persisted for six months and never attained a much larger size. (d)—Plate II.—Examination one year later showed that the rarefied area had shrunk to a small size, but was still discernible as a ring in the hilus region. Tubercle bacilli were found in the sputum. (Courtesy of Dr. H. E. Kessler.)

Radium and Roentgen Ray Therapy in Malignancy: Indications, Contra-Indications, Limitations and Recent Developments*

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THE use of radium and roentgen ray in the treatment of certain diseases is gradually assuming a more and more important place in medicine. This is particularly true of malignant conditions, in the treatment of which radiation bids fair to become increasingly important. Unfortunately the proper evaluation of these agents, as in the case of all other therapeutic agents in their early days, is being made more or less difficult by the usual troubles of youth and by more or less exaggerated claims. All of this brings forth, from the less interested members of our profession, indications of a skepticism which, even if at times partly unwarranted, is bound in the long run to help us maintain a more judicious and more sanely critical attitude toward our work.

If we wish our progress to be steady and as free as possible from the missteps and reversals which have marked the development of every branch of science, we must base our practice on sound principles and formulate our technique from information laboriously and patiently obtained by the physicist, the biologist, and the pathologist.

Before considering more in detail the use of radium and roentgen rays in the treatment of malignancy, I should like to emphasize briefly certain well known fundamental factors, the importance of which is not always sufficiently realized. Some of these factors impose on us limitations that we are constantly striving to overcome.

INVERSE SQUARE LAW

As we know, therapy by radiation is absolutely dominated by the inverse square law, the practical importance of which is so great that in making any application of radium or roentgen rays, it should automatically become the radiologist's first consideration.

For example, if a tube of radium is placed with relation to a malignant growth the intensity at points 0.5, 1.0, 5, and 10 cm. from the tube will be, respectively, 1, 1/4, 1/100, 1/400 (taking as a unit the intensity at 0.5 cm.). If the dosage was correct for a distance of 5.0 cm. from the tube, it must follow that the portion at 0.5 cm. will be burned by a dose one hundred

times too great, while the portion at 10 cm. distance will receive little or no therapeutic effect. In principle, this law applies to both radium and roentgen rays. While this difficulty cannot be overcome completely, its consequences can be avoided to a considerable extent, as far as roentgen rays are concerned, by increasing the distance between the tumor and the source of radiation. We can thus minimize the difference between the intensity of the rays as they enter the proximal surface of the tumor and as they leave the distal surface. In other words, the different parts of the tumor will receive a more uniform quality of radiation. However, the associated disadvantage is a great loss in the total intensity available, a loss which must be compensated by a great increase in the time of exposure.

Another way of avoiding the consequences of the inverse square law is to increase the number of sources of radiation; this may be accomplished by multiplying the number of areas treated. In this way, as many multiples of a single dose may be concentrated into a limited internal area as the number of different superficial areas through which the treatment can be given. This latter method should be selected in treating a tumor situated at approximately equal distances from two opposite surfaces of the body. In some cases a combination of the two methods may be advisable or necessary. However, should the tumor be superficial, increase in focal distance alone is to be preferred as a means of increasing the dosage delivered to the tumor. Such increase in distance should, of course, be adequately compensated by increase in time of exposure.

The only way to overcome the handicap of the inverse square law with any degree of effectiveness in the case of radium is by burying the radiation units in the tissues and increasing the number of those units. This may be accomplished by inserting into the tissue tubes of radium emanation which are allowed to remain in place either temporarily or permanently. However, because of the short and rapidly decreasing period of activity of radium emanation, and because of the necessity of leaving in place the small glass containers, but particularly because of the

intense necrosis produced around such unfiltered radiation elements, the use of buried emanation, while undoubtedly of great value in many cases, will probably be gradually replaced, at least to some extent, by the use of radium needles containing a definite quantity of radium salt of stable activity. These needles, with varying degrees and qualities of filtration, aid in avoiding some of the tissue necrosis occurring around an unfiltered glass emanation unit. Such necrosis is definite and complete within a zone, the extent of which is proportionate to the radium content of the tube. (2)

The question of filtration is becoming more and more important. We know that the rays from a roentgen ray tube or from a radio-active substance, such as radium or its emanation products, are not homogeneous, that is, they are not made up of rays of one wave-length. On the contrary, such rays are extremely heterogeneous, being composed of a mixture of rays of all wave-lengths. The longer, being easily absorbed or weak in penetrating power, do not pass beyond the first layers of tissue cells, while the rays of shorter wave-lengths penetrate deeper and deeper into the tissues. This complex character of roentgen rays and radium rays, to which their unequal absorptibility is due, constitutes another major limitation in efficient therapy by radiation, a limitation almost as great in its effects as the inverse square law. Such limitation may be minimized to a considerable degree by filtration. In treating a malignant tumor with roentgen rays, attack must generally be made through the skin or mucous membrane, both of which are extremely sensitive to so-called soft rays, or rays of long wave-length. This fact has brought grief to many radiologists in the past, and we still occasionally are reminded that the skin will withstand only a limited degree of insult. By adequate filtration, wave-lengths least injurious to the tegument can be selected. In other words, the softer rays are absorbed by the filter which prevents them from injuring the skin or mucous membrane. Another very important point is accomplished, namely, an increase in the homogeneity of the effective radiation, or rather a decrease in its heterogeneity.

*—Presented before the Radiological Society of North America, December 7-9, 1921, Chicago.

The situation with regard to radium is quite different. If we wish to treat a lesion by external application we must use heavy primary and secondary filtration in order to avoid serious burns. One millimeter of platinum or its equivalent will filter out all the β rays and the less penetrating portion of the γ rays. Two or three millimeters of rubber will eliminate the secondary rays generated by the primary radiation in the metal used as a filter. If we wish to attack a lesion by burying in it radium or its emanation, filtration may not be necessary, especially in tumors of relatively small size. Around each unit of radium or its emanation so placed, there occurs destruction in the form of necrosis which may be more or less extensive according to the dosage. Beyond this zone of necrosis, the tissue constituents of which act as a filter, a so-called selective effect is obtained. The tissue adjoining the radio-active substance filters out the softer, less penetrating rays, to which the necrotic effect is due, and the effect of that portion of the radiation which has gone through this zone unabsorbed then depends on the radio-sensitiveness of the tissue cells outside that zone. When buried emanation is used the zone of destruction is greater because nearly all of the β and γ radiation passes out of the glass tube; whereas with platinum needles, or other filters of relatively high density which allow the escape of only the more penetrating portion of the β and γ radiation, the zone of destruction is more limited.

By far the most serious limitation in the diagnosis and treatment of pathologic lesions springs from the fact that we must depend almost entirely on our human eyes and hands. These are very gross instruments and, even with very effective therapeutic agents, we can never hope to accomplish the cure of more than a certain proportion of the malignant diseases we may undertake to treat. Those of us who have had experience with pathologic conditions found at necropsy know but too well the uncertainties and deceptions of our methods of physical diagnosis. Some consolation may be derived from the fact that the radiologist's limitations in this respect are shared equally by the surgeon and the internist. It is a very common occurrence to find that a malignant lesion supposedly limited to a certain organ or tissue had actually become much more widely disseminated either by direct extension, by metastasis, or both. The only way we have of combating this limitation is by impressing on the public and members of the profession in general the extreme importance of early diagnosis and treat-

ment. Although something can be accomplished in this direction, the very limitation in the acuity of our senses often makes an early diagnosis in the first instance difficult. It is not unusual to be told by patients that when they first consulted a physician concerning a lesion which appears to have been an early manifestation of a malignant process they were told that it was of no significance and that they should promptly forget it. Such instances influence us to conclude that physicians are as much in need of "education" as the public in this most important matter.

INDICATIONS AND CONTRA-INDICATIONS FOR RADIUM AND ROENTGEN RAY THERAPY

Our first consideration must be the diagnosis; because, if we are to utilize radium or roentgen ray therapy with any degree of success, we must know the nature of the lesion we wish to treat. Not only should we know the type of malignancy, but as many as possible of its salient features, such as the predominating type of cell, and reaction factors. It is not always possible, nor in some cases is it necessarily advisable, to obtain such complete information. Judgment should be applied to the individual case. The lack of a definite diagnosis constitutes a fundamental contra-indication to such treatment. The other important contra-indications are:

1. The bad general condition of the patient, making it impossible or dangerous to administer really adequate treatment.
2. Tumors complicated by infection. This condition is not infrequently encountered, especially in association with carcinoma of the uterus, but occasionally also in other locations such as the breast. In such cases drainage and other general measures must be instituted before radiation.
3. Lack of suitable apparatus, or the knowledge requisite for its proper use. We occasionally still hear of physicians attempting to treat malignant conditions with such facilities as are provided by an ordinary portable bed-side unit.

Radium is particularly indicated when we are dealing with a fairly small lesion or tumor at or near the surface of the body (or reasonably accessible from the outside) and the extent of which can be outlined with a fair degree of accuracy. Its ideal indication is in conditions in which it is possible to introduce the agent into the substance of the lesion in such a manner as to deliver to every part fairly uniform radiation in adequate dosage.

At the present time radium, alone or in conjunction with roentgen rays, is indicated and should be used (preferably by the needling method) in cases of solitary glandular carcinoma or sarcoma of limited size and well defined extent, especially on or near the surface of the body; and in cases of solitary or discrete, superficial, malignant gland or cutaneous metastasis. Malignant conditions in cavities accessible from the body surface (uterus, vagina, rectum, bladder, mouth, nose, larynx and esophagus) should preferably be treated with radium or its emanation, usually in conjunction with external roentgenization. In cancer of the uterine cervix, for instance, radium achieves marvelous results in many cases because the element can be introduced into the cervical canal and is there surrounded on all sides by the neoplastic tissue. From our present knowledge the method of employing therapy by radiation to the best advantage in such conditions would seem to lie unquestionably in the combination of radium internally and roentgen rays externally.

The γ rays of radium are more penetrating than the roentgen rays used at present for therapeutic purposes. Experimentally, roentgen rays have been produced with wave-lengths as short as some of the γ rays, and these may be available before long. However, with the small dosages commonly used, the total radio-active energy delivered to a lesion or tissue beneath the surface is very small, and constitutes an extremely small fraction of the total γ radiation generated by a given quantity of radium. Furthermore, our present means of employing radium for therapeutic purposes are such as to make it impossible to deliver uniform radiation to a lesion of any extent on the surface. This difficulty is magnified many times when we are dealing with a deep lesion the exact extent of which cannot be outlined accurately. These factors determine in a very large measure the indications for the use of radium or roentgen rays.

Roentgen rays act at a more uniform intensity over a much wider field than radium rays. Although their intensity decreases rapidly as they pass from the surface to deeper and deeper tissue layers, a portion of this loss can be compensated by increasing filtration, focal distance, and the number of so-called ports of entry. Therefore, if we are dealing with an extensive superficial lesion or with a lesion, either superficial or deep, whose exact extent cannot be fairly accurately outlined, roentgen rays are the agent of choice. Tumors with a tendency to metastatic dissemination by way of the lymphatics,

or growths in which metastasis is suspected or to be expected, should be treated either by roentgen rays alone or combined with radium. The neck with its complicated lymphatic system in malignancy of the mouth or face, and the thorax and axilla in cancer of the breast serve as illustrations.

Combination of roentgen rays and radium.—Although the indications for roentgen rays or radium are usually quite well defined, there are many cases in which both should be used in conjunction. As a matter of fact, the ideal method of treating many malignant tumors is by a judicious selection or combination of surgery, roentgen rays, and radium. In selected cases, surgery should be a preliminary step to prepare the field and to permit direct visual application of the radium, to be supplemented or not by roentgen radiation. If anything really substantial is to be accomplished in the therapy of malignant conditions by radiation, our procedure must be based on one essential requirement. The entire involved area with its lymphatic drainage, must receive a uniform lethal dose, which should be delivered, as nearly as possible, during the first treatment. I do not mean to imply that it is necessary to give such dosage at one seance, but the treatment should be completed within as short a period as the condition of the patient and the degree of reaction will allow. To scatter a course of treatment over a period of weeks is to defeat the very purpose we are attempting to achieve. If involvement is limited and it is reasonable to expect a cure, we should aim to destroy the malignant elements by one attack. As heavy dosage as the integrity of important neighboring structures will allow should be administered with adequate filtration in order to minimize as much as possible the deleterious effects of the long wave-length portion of the radiation. Limited radiation with limited dosage is to be used when a cure is out of the question and only palliation is to be expected.

The importance of treating the lymphatic system draining the area of a malignant tumor cannot be overemphasized. Untreated elements not uncommonly show signs of activity. This is of especial importance in carcinoma, the dissemination of which takes place so largely by way of the lymphatic system. Although this consideration might seem self-evident the manifest lesions only are often treated in a scattered fashion and the lymphatic drainage system overlooked. In fact, in most malignant conditions the lymphatic drainage system should be treated before attacking the main lesion. In gen-

eral, we should adopt the same procedure in sarcoma, although in these cases dissemination by way of the blood stream is the rule. The anatomy and physiology of the circulatory system and the general pathologic features of carcinoma and sarcoma enable us to understand why in the former metastasis usually takes place through the lymphatic system but in the latter occurs by way of the blood stream.

Sarcoma, especially sarcoma of bone, has a very great tendency to metastasize to the lungs. ⁽¹⁾ It is difficult to say why this is true. There seems to be very little doubt that the dissemination of metastatic elements or emboli takes place quite early and the reason many of these do not lead to gross secondary lesions possibly is due to the activity of some defensive mechanism elaborated in the body fluids as the result of the antigenic action of the primary growth. An explanation of the fact that metastatic elements which give rise to secondary lesions have such a predilection for the pulmonary organs may perhaps be found in the fact that the pulmonary circulation constitutes the first capillary bed through which the blood from the general circulation passes.

Whatever may be the truth with regard to metastasis, the questions arise: Should we make it a routine practice to radiate the mediastinum and lungs in sarcoma in the hope of destroying metastatic deposits, even if not demonstrable? Should we radiate the mediastinum and lungs at all? Should we treat only these organs or should we attempt to radiate the entire trunk on the basis that, while pulmonary metastasis is the most frequent site, metastasis not infrequently occurs in other organs?

In a recent personal communication, Bloodgood writes with regard to this question: "In a number of cases the x-ray (examination) of the lungs was negative, and after amputation, radiation of the chest was performed on one or more occasions; in spite of which metastasis developed. Similar observations in three cases of sarcoma of the soft parts. Up to the present time I have no evidence that radiation of metastasis of the lungs has had any effect even if done before metastasis shows in the x-ray." From this statement we are forced to accept one of the three following conclusions: (1) the dosage was inadequate, (2) the quality of the radiation was not suitable, or (3) radiation will not achieve the destruction of such metastatic foci. There is the further possibility that if radiation is to be really effective in controlling metastatic dissemination to the

lungs not only the mediastinum should be treated, but also the lungs, because metastatic emboli must often be carried beyond the larger radicles well into the substance of the organ.

If an attempt is made to administer so-called prophylactic treatment to the contents of the thoracic cavity for metastatic sarcoma or carcinoma, such treatment should be extremely thorough and should be given early, even though it be impossible to demonstrate metastatic foci.

Unfortunately, in the majority of cases when the liver or lungs become demonstrably involved, the condition is usually almost hopeless. We may, however, look forward to the time when further developments in technique may make it possible to do more toward checking metastatic deposits. Pfahler has shown that in some cases it is possible to influence the development of metastasis in the bony substance of the vertebral segments. However, we are not justified in increasing the discomfort and suffering of a dying fellow-being when we know that all our previous efforts to cure him have been unsuccessful.

The group of malignant conditions classified under the general head of lymphoblastoma, which includes Hodgkin's disease, lymphosarcoma, and allied conditions, presents a difficult problem. Characterized as these are by a tendency to progressive involvement of the lymphatic elements their exact status remains unsettled. In many cases in which the cervical glands are enormously enlarged, we can obtain a rapid and at times a truly startling reduction by means of radium. Other important groups of glands such as the mediastinal, and paravertebral, should also be treated, and this can be done most efficaciously by roentgen rays. It is questionable if the reduction of enormous adenopathies by radium may not in some cases be too rapid, and if a more gradual, though slower, regression would not yield better results. For the present we must be guided by our judgment in individual cases.

Preoperative radiation.—The practice of radiating a region after preliminary surgical amputation of the grossly malignant tissue has become a routine practice in many cases as in carcinoma of the breast. Although a sound technique may yield good results, it is doubtful if our hopes are really justified or will be realized. Often operation performed with the intent to rid the patient of cancer leads to more or less rapid dissemination by grafting, or by venous or lymphatic absorption. The rational procedure, therefore, would seem to be for the surgeon not to op-

erate before the involved part and its lymphatic drainage have been thoroughly radiated. Aside from the principle involved this would be of decided advantage in cases of carcinoma of the breast particularly, because the radiation could be administered much more effectively before operation, since there would not be a recent wound to prevent the arm from being well abducted. The entire axilla could thus be much more thoroughly and uniformly treated, and the tendency to malignant cell dissemination at the time of operation would be diminished. This principle may be applied to the surgical treatment of malignant conditions in general, except, of course, in the cases in which surgery is intended as a preliminary step before radiation.

The surgeon wishes to know how long an interval should be allowed between radiation and operation. The early response of tissues subjected to radiation consists essentially in a modified inflammatory reaction, beginning as usual with edema; the reaction is more intense and more localized, if radium is used, and less intense and more diffused if roentgen rays are used. The tissue cells gradually recover if the dose has been light; there is inhibition of their reproduction and development if the dose has been moderate; the cells may be completely destroyed if the dose has been lethal. The products of such destruction are removed by autolysis and absorption, and later are replaced by fibrosis. This is true of normal as well as of pathologic cells. Generally neoplastic cells are more sensitive to radiation than normal tissue cells, and on this fact is based the entire radiation treatment of malignancy.

In many patients radiation produces so-called deep radiation sickness, a temporary state characterized by nausea with or without vomiting which may be quite pronounced, anorexia, headache, a sensation of general weakness, nervousness, and sometimes by fever. This state may last in some degree for from a few hours to several days; a few patients remain nauseated and weak for as long as two weeks, during which time they eat little and lose weight. Such reaction, which is usually shorter and much less severe in persons treated with radium than in those treated with roentgen rays should be allowed to subside completely before the patient is subjected to the ordeal of a major operation.

As a rule, severe reactions are observed only when some part of the abdomen has been treated, and this is particularly true of the upper half. Therefore, the interval between radiation and operation must depend largely

on the relative importance of these factors in a given case. In carcinoma of the breast radiation sickness is usually either absent or slight and so the operation could readily follow within a week. In carcinoma of the uterus, however, the radiation is administered by means of radium internally and by external roentgenization, and the interval should be from three to four weeks.

After radiation the tissues should be in comparatively good condition for operation, and the surgeon should not encounter any particular delay in the repair of the wound. It is doubtful if the surgeon will have any difficulties in carrying out the various steps of the operation, after a single course of treatment, especially if a proper interval has been allowed before operation. Even though the operation is made more difficult by radiation, few surgeons would hesitate to adopt it if the final results from the standpoint of the patient can be improved. Preoperative radiation should also tend to minimize the danger of tampering with a malignant lesion in order to obtain a specimen for diagnosis.

Postoperative radiation.—Postoperative radiation may be and often is more or less illusory. The most important requirements in rendering innocuous such invisible malignant elements as may have remained after surgical ablation is a correct selection of the agent and its use in adequate dosage. Should radium or roentgen rays be used? If we wish to sterilize an entire region, as following removal of the breast, radiation should be administered not only to the field of operation, but to its lymphatic drainage. Roentgen rays properly applied will best meet the condition. Radium should be reserved for small well-defined territories, especially if the agent can be introduced into the center or the substance of the tissues, as the vaginal vault following hysterectomy (in conjunction with roentgen rays from the outside), or into the cavity left after the removal of a tumor of limited size. However, in the latter, the radium should preferably be introduced at the time of and as a part of the operation. Radium used postoperatively, and blindly pushed or slipped into a drainage tube placed by the surgeon at the time of the operation is, at best, a very uncertain procedure.

If there has been no preoperative radiation, the patient should receive the treatment as soon as possible after operation. If the operation has been preceded by radiation the postoperative interval must be governed by the preoperative interval; due consideration should be allowed between operation and radiation. In cases of carcinoma

of the breast treatment might be commenced within one week, whereas it might seriously jeopardize the patient's chances of recovery if radiation were begun so soon after an abdominal operation.

How often should this postoperative, or so-called prophylactic radiation be repeated? In the absence of glandular involvement if the dosage has been estimated correctly, two to three thorough courses of treatment should be sufficient, particularly if one of these courses has been administered before operation. If the dosage has not been correctly estimated, however, we can hardly expect to achieve good results by prolonging our efforts indefinitely.

RECENT DEVELOPMENTS IN TECHNIQUE

During the past few years radiologists and members of the medical profession in general have been startled out of their usual complacency by reports of wonderful advances in the roentgen ray therapy of malignant diseases. Such reports have emanated very largely from German clinics and have led us to believe that very much better results can be obtained than formerly.

A study of original sources and the reports of several American observers in Germany show that no two of those clinics employ the same technique. Although there is a wide difference of opinion with regard to many details in the application of treatment, there is a reasonable degree of unanimity on a few points: (1) the use of higher voltage; (2) the use of "higher" filtration and the advantages of copper or zinc over aluminum as a filter; and (3) the use of increased focal distance. There are strong theoretical reasons for believing that these factors will exert a great influence on pathologic processes of a neoplastic nature, but only time and greater experience will enable us to decide whether or not such influence will be purely beneficial and to what extent.

Seitz and Wintz⁽⁵⁾ have advanced the idea, based on what seems to be very painstaking research, that different malignant and other conditions respond to definite dosages. Thus, they have found that the dose for carcinoma lies between one hundred and one hundred and ten per cent of the unit skin dose; the dose for sarcoma is given as from sixty-five to seventy per cent, and the dose for castration was determined to be thirty-five per cent. These figures, I believe, were not intended to be interpreted too literally. It would be very difficult indeed to reconcile any such fixed limits of dosage with what we know of the very considerable variability in the metabolism of a given type

of malignant cells. For example, in carcinoma there is often a tremendous difference in activity between tumors in patients of the same age, not to mention the variable activity of tumors in patients of different ages. Even the influence on the growth of tumors of such factors as lymphocytic infiltration, fibrosis, differentiation, and hyalinization, either singly or in combination⁽³⁾, make it very difficult to accept such arbitrary ideas of dosage.

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Roentgen Ray Anthropometry of the Skull*

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LETTER OF TRANSMITTAL
Dr. A. W. Crane, Chairman,
Dr. P. M. Hickey,
Dr. H. K. Pancoast,

Members of the Committee of the
Leonard Prize for Research.

Gentlemen:—

A research submitted in commemoration of the memory of Dr. Charles Lester Leonard should possess, I believe, two essential attributes; in the first place, it should be a research original in the sense that the labor involved in its pursuit was inspired as an unselfish offering of devotion to the immortality of the martyred pioneer; and, secondly, it should represent a concept born wholly of American ingenuity for which Doctor Leonard was especially famed.

X-rays, radium and radio-activity present phenomena of limitless variety; so that it is not difficult to select a theme for research, the subject matter of which has not yet been investigated. The selection of a subject matter is necessarily modified by the circumstances of environment in which the investigator is immersed. The selection, therefore, of the topic of roentgen ray anthropometry was made on the basis of originality of concept, there being no consciously propounded and scientifically defended system of x-ray anthropometry anywhere extant; and made also because of the possibility of serving the interests of arts and sciences other than medicine alone.

*—This thesis was awarded first place in the Leonard Research Prize Contest offered by the American Roentgen Ray Society during the year 1921. It was submitted under motto:

"Every scientific research casts a light beyond itself; but the extent to which this light is perceived depends upon the man."

There are other themes, some of them possibly more absorbing and in which the medical profession of an entire world is at present interested, that could have been selected for investigation. But these avenues of research already have established precedents; and their further study could hardly be considered original, but rather additional research. For this reason the fruitful field of x-ray or radiotherapy was entirely excluded.

It is a pleasure to be permitted to offer this thesis for the critical consideration of your committee; for if the announcement of the Leonard Prize for Research has stimulated in others, as it has stimulated in me, a sense of imaginative originality and a desire to emulate an American leader in x-ray, there can be no doubt that the collected efforts will serve as additional supports to maintain American x-ray activity as a world example of scientific achievement.

Respectfully,

A. J. PACINI.

June 24, 1921.

INTRODUCTION

THE province of physical anthropology has for its scope a comparative study of the human body and its inseparable functions. It treats of the causes and ways of human evolution and with the development, transmission, classification, effects and tendencies of man's bodily and functional differences (Hrdlicka). From which it may be gathered that the methods of physical anthropology are in many instances the methods of medical diagnosis, more especially in the study of morphologic changes incident to aberrant functions of the endocrines.

It does not appear that roentgenology has heretofore been propounded as the basis of an anthropometric system useful alike in anthropologic medicine

and in medical anthropology; and this thesis presents a propounded and defended system of roentgen ray anthropometry useful to serve both the anthropologist and the physician in the common objective of the study of "human evolution, development, transmission, classifications, effects and tendencies of man's bodily and functional differences."

Modern science is based on the record of past investigation. This condition must, therefore, apply to roentgen ray anthropometry, which is essentially a new science. If the roentgen ray is to serve as an agent fundamental in a system of anthropometry, it is obvious that the method involved must meet the rigid requirements of anthropometry established by the Monaco and Geneva Agreements. As there are also certain standards that must be met by roentgen ray methods, the thesis divides itself into Part I, where the technique of the investigation is first critically considered; Part II, where the principles common to physical anthropology and to roentgen ray anthropometry are discussed, followed by the records of measures of anthropometric entities such as diameters, angles and indices in a series of skulls; Part III, which includes the measures derived by the system of roentgen ray anthropometry elaborated, and contact prints of the skulls from which these measures were derived; and Part IV, which is a bibliographic reference list carefully compiled and of attested accuracy, including references only to such articles as have a direct bearing on the various topics in anthropometry presented in the thesis.

In connection with roentgenologic methods appreciative acknowledgment is extended to Dr. Leon T. LeWald, Dr. William M. Manges, Dr. Frederick M. Law and Dr. I. Seth Hirsch, and to Dr. E. W. Eldridge, who conducted all of the exposures, the prints

of which appear in the accompanying atlas.

To Dr. William A. White, superintendent of the Saint Elizabeth's Hospital for the Insane, and Dr. Walter F. Treadway, Chief, Section of Neuro-Psychiatry, Hospital Division of the United States Public Health Service, thanks are extended for permission to make use of some of the many mental defectives under care at the Saint Elizabeth's Hospital.

Before propounding this system of roentgen ray anthropometry it was desired conclusively to establish for it the same degree of accuracy usual to physical anthropologic methods. To gain this, instruction in anthropometry was had at the United States National Museum⁽¹⁾ under the personal instruction of Dr. Ales Hrdlicka, to whom appreciation is extended. The sliding and spreading compasses used for the measure of skulls to serve as standard for x-ray measures were obtained from Collin, Paris, through the help of Mr. Louis Leonard Shapiro.

Thanks are extended to Mr. Earle T. Bailey, who shared in the labor of reporting the measures taken and who contributed thoughtful suggestions in the matter of the design of certain instruments which will be described.

All of the references contained in the bibliography were procured by Miss Margaret Doonan, Librarian, office of the Surgeon General, U. S. Public Health Service. Many more volumes were consulted than are recorded in the bibliographic list; so that the work contributed by Miss Doonan in securing the necessary books from the various sources was even greater than would appear from the number of references recorded. It is desired to acknowledge every appreciation of her untiring and zealous assistance.

The contact prints that appear in the atlas were prepared by S. W. Nourse, whose co-operation in this matter is appreciated.

Finally, the labor involved in the preparation of the manuscript was shared by Miss Elmira R. Poteet, Miss Deborah Aaron and Miss Anna A. D. Rekus, and to these stenographic assistants my greatest thanks are extended for their faithful endurance in bringing to a conclusion what must have been for them a most tedious task.

PART I.

TECHNIQUE OF THE INVESTIGATION Apparatus

THE selection of adequate apparatus for the pursuit of roentgen ray anthropometry is determined by two factors; first, it must include all those appurtenances that contribute to the

production of the median sagittal projection of the cranium, combining accuracy and simplicity; and secondly, it should not necessitate additional, nor more elaborate apparatus than that allotted to the average roentgen ray laboratory.

There exist many forms of head immobilization apparatus, such as that pictured in Hirsch's "Principles and Practice of Roentgenological Technique"⁽²⁾ representing the model introduced by Dr. Percy Brown; but the simplest apparatus is the vertical stereoscopic plate changer. This apparatus is usually a part of the equipment of all laboratories; though in its stead, any vertical plane against which the head may be rested will suffice for this investigation. A modern transformer of the usual type, and adequate to furnish thirty milliamperes of current and six inch spark gap, will be found a satisfactory generator. Either Coolidge or gas tubes can be used. It would seem that plates make for greater definition than is obtained through the use of duplitzed x-ray films; but the facility in handling and especially in the storing of films is so great as to make their use of practical advantage over the use of plates.

In exposing the head, teleroentgenographic technique (the removal of the tube two meters from the film) makes for minimum distortion of the projected skull structures. However, even at this distance, there is some distortion by reason of the fact that the median sagittal plane of the head is removed from the film and also by reason of the fact that at two meters the emergent x-ray bundle consists of rays that are nearly, but not absolutely parallel. In addition, as the distance is increased, the time of exposure must be increased directly as the square of the distance; and unless intensifying screens are used, which is not recommended, the ensuing prolonged exposure borders on the depilating dose of roentgen ray. In order, therefore, that a shorter film target distance could be employed, the following method was adopted for the

Actual length of bob (50 mm.) : Roentgenographic length of bob (50 plus mm.) : X : Roentgenographic length of skull measures.

or,

$$X = \frac{50 \times \text{Roentgenographic length of skull measures}}{\text{Roentgenographic length of bob}}$$

exact correction of distortion owing to ray divergence. A rigid brass bracket is attached to the vertical plate changer. On the arm of the bracket a slide is arranged, the under part of which holds a brass protractor. A monel-metal bob is suspended from the slide by means

of braided silk (Johnson and Johnson surgical braided silk No. 8). The vertical plate changer is adjusted so that the bob hangs perfectly parallel to the plane of the plate changer. This is indicated by the marks on the dial of the slide. The metal bob is machined so that its overall length at room temperature is exactly fifty millimeters. A duplitzed film, fourteen by seventeen inches, is loaded in an exposure folder and attached to the front of the vertical plate changer by the use of adhesive tape; or the usual cassette loaded either with a plate or a film may be used in the plate changer. The subject is seated directly in front of the plate changer and the head turned to the right so as to procure a dextro-sinistral exposure. The head is placed firmly against the vertical plate changer, and, after adjusting it so that the median sagittal plane of the head is perfectly parallel to the plane of the plate changer, is strapped by the use of three-inch gauze bandage so as to assure secure immobilization. With the head in this position, the slide is moved so that the metal bob hangs in the plane of the median sagittal section of the head, and the exposure is made. The finished film will show a lateral view of the head and a reproduction of the bob. The bob will be increased in size according to the amount of angular divergence of the roentgen ray bundle; and since it is in the median plane of the head, every median measure of the cranium is also increased to an amount proportional to the increase in the length of the bob. The roentgenographic length of the bob is measured with a steel rule in millimeters, interpolating to half a millimeter. From the proportion between the length of the bob as it is measured on the roentgenogram, hereafter called roentgenographic length, and the known actual length (fifty millimeters), a co-efficient is established, which, applied to the roentgenographic measures of diameters in the median plane, gives the true values corrected for divergence. The calculation is expressed by the equation:

The technique described is independent of the focus of the tube. Tubes supposedly of the same focus do not have the same constant of x-ray divergence; and, of course, tubes of different focus have quite different degrees of x-ray divergence; but by the method

FROM BROCA'S "INSTRUCTIONS CRANIOLOGIQUES ET
CRANIOMETRIQUES", PARIS, 1875, (PLANCHE VI)
AND RIBBE, THESE 97, PARIS, 1885.

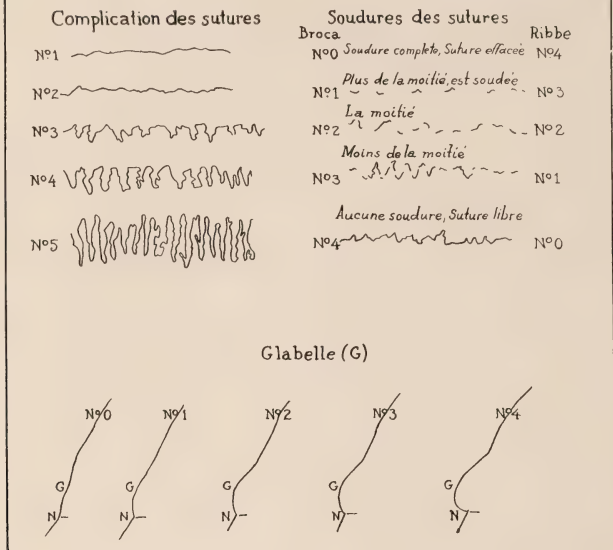


Figure I.

outlined, tubes may be used interchangeably without fear of reducing the accuracy of the subsequent measurements.

Torque-like winding of the bob is prevented by the use of braided silk. The vibration in the room produced either by a rotary converter or the motor of the rectifying disc may impart a barely perceptible swing to the hanging bob; but the purposely rounded ends of the bob, in swaying move radially and, therefore, do not cast any appreciable indistinctness on the roentgenogram; so that the error introduced from any gentle tremor of the bob during exposure is virtually indeterminate and needs no correction.

In order to expedite calculations, the x-ray divergence protractor may be used. This consists of a transparent celluloid plate upon which appear certain rulings. The protractor is placed on the film and moved until the bob falls within the upper and lower limits of the ruled area; and on the graduation nearest to that point appears the fraction or coefficient by which all

sagittal measures of the skull must be multiplied in order to convert roentgenographic lengths to actual lengths.

The rulings and graduations of the protractor are so spacious as to permit interpolating to the third decimal place; thus, if the roentgenographic length of the metal bob falls between the marks

0.78 and 0.79 on the protractor, one would use the factor 0.785 as the coefficient of correction.

In Fig. 2 a blueprint tracing of the divergence protractor is shown.

Position of the Subject

Right-handed individuals should be posed in the dextro-sinistral view, and contrariwise, left-handed individuals in the sinistro-dextral view. Anthropometric research establishes that the cranial vault is somewhat longer on the left than on the right side. This seems to result from the greater length of the left cerebral hemisphere in right-handed individuals. For this reason, since the greatest antero-posterior diameter of the skull is one of the measures sought, and in observance of the first cardinal principle of roentgenography ⁽³⁾ the right or left handedness of the subject must be established and the exposure so made as to present the clearest definition of the longest cranial half.

When sagittally rayed from one posture and a single exposure, the roentgenogram of the head can not be expected to show all of the cranial structures in their minutest detail. The lamboid suture is frequently readily visualized; the coronal suture may be seen sometimes in the younger subjects, but even in these it is usually imperfectly outlined. The central ray should be directed at a point one inch above and one inch in front of the external auditory meatus (as in the case for the exposure of the sella turcica).

Knox, in his book on radiography and radiotherapeutics, refers to the method described by Doctor Finzi and improved by Trevelyan George for securing a perfect alignment of the head when undertaking sagittal exposures.

"A useful method for the radiography of the sella turcica has been described by Dr. Finzi.

The patient is placed upon the

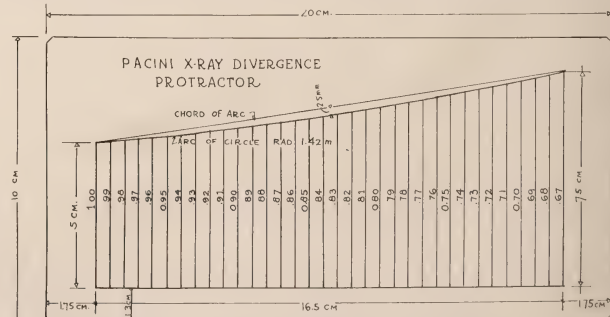


Figure II.—Divergence protractor. Made of transparent celluloid. It is applied over the film or plate to measure the roentgenographic length of the bob. The coefficient corresponding to the roentgenographic length is applied to all median sagittal measures, thus correcting the roentgenographic measures to true values.

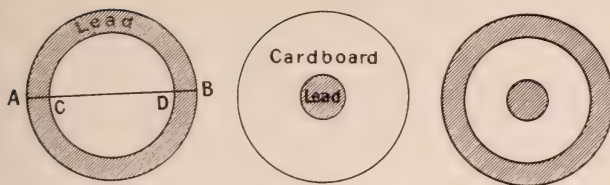


Figure III.

couch and the tube centred from below. To determine the exact position two small coins are placed one in each ear. After these are superimposed under the screen, the tube is then moved upward and forward one inch in each direction, and the radiograph taken. A perfect picture of the area required should be obtained.

"There is one objection, however, to this method, and this is the obvious one that the lower coin (assuming the tube to be beneath the table) will cast a larger shadow on the screen than the upper one, and therefore, as both coins are opaque, it is not possible to say when the smaller shadow is exactly in the centre of the lower one, as it should be if the view of the head is to be a strictly lateral one.

"To obviate this defect Trevelyan George has substituted a lead ring for the lower coin (again assuming the tube to be below the table). This is very simply made by describing two concentric circles on a piece of thick sheet lead and cutting away the superfluous metal. Exact measurements are not essential, as ears differ much in size, but a convenient size is obtained by making AB equal to twenty mm., and CD equal to fourteen mm. (See Fig. 3), and a convenient thickness of sheet lead to use is one and one-half mm.

"Instead of the upper coin a circular lead disc, cut out of the same sheet of metal, is used, a suitable diameter being seven mm.

"Now, it is of the utmost importance that the two articles, the ring and the disc, be placed symmetrically in the auricles, and as they differ in external diameter, this raises a difficulty. In order to get over this, the diameter of the disc is artificially increased to that of the ring, that is, to AB, by embedding it in a circular hole of the proper size cut in a piece of cardboard of about the same thickness as that of the lead, and trimming the

cardboard to the necessary size and shape. To keep the disc firmly in its place within the cardboard, two circular discs of thinner cardboard are cut with diameters equal to AB, and cemented with glue or seccotine, one on each side of the compound disc of lead and cardboard. The result is a disc which looks as if it were made entirely of cardboard, but which really contains the lead embedded in a central position in it. Wood or other partially transparent materials can of course be used instead of the cardboard. A coating of 'new skin' renders the disc waterproof, and it can then be washed after each case."

This method was used, but did not offer results differing from those obtained simply by judging the head to be in the median sagittal plane. It offers the disadvantage of casting confusing shadows of the lead ring and disc that interfere with the visualization of anthropometrically important anatomic structures, more especially the silhouette of the external auditory meatus. If there is any doubt in the mind of the investigator about his ability definitely to judge the head to be in the median sagittal plane, the nasion or glabella, and the menton may be

TABLE 1.

FACTORS OF EXPOSURE.

	When D.C. machine is used.	When A. C. machine is used.
Target-film distance--inches.....	30	30
Spark gap--inches.....	6	5
Milliamperes.....	30	30
Time in seconds for:		
Laterally thin heads.....	7	9
" medium heads.....	8	10
" thick heads.....	9	11

marked with wax pencil on the skin of the subject; and with the subject facing the bob the head may be so aligned that the thread of the bob superimposes the marked points, when practically perfect median sagittal posture will be assured.

As will be discussed in that part of this study dealing with descriptive roentgen ray anthropology, certain relative values are adjudged by inspection. Thus, the relative size of the skulls is a factor useful in determining the sex formula. Any series of observations should, therefore, be conducted as nearly as possible under the same conditions in order that the relative comparisons may be on a similar basis. The enquirer should use the same tube throughout a whole series, or, in case of breakage, a tube of the same focus should be used in replacement. The film-target distance should be approximately identical for each consecutive exposure. The focus should in each case be directed at the site mentioned; that is, an inch above and one inch in front of the external auditory meatus. By maintaining these factors throughout, the resulting roentgenograms are relatively comparable in the evaluation of characteristics as will subsequently be described.

Exposure Factors

Much depends upon the current supplied to the high tension transformer. If the initial power is direct current, and must therefore be converted to alternating, despite the fact that the tested setting on the machine may give a spark gap and milliamperere meter reading identical to that obtained with a machine initially supplied with alternating current, the finished roentgenograms are appreciably less distinct in the former instance; so that two sets of exposure factors are advised, one to be used when the initial supply is direct, and the second when the initial supply is alternating current. These factors represent averages suggested by Dr. I. Seth Hirsch, Dr. Frederick M. Law, Dr. Leon T. LeWald and Dr. W. W. Eldridge.

Others factors were used, varying the spark gap, or the milliamperes, or the distance, with corresponding compensation in the time of exposure; but no technique was found that would give better general results than the factors submitted. In the case of alternat-

ing current machines the factors are such as can be obtained by the average bedside unit equipped with a thirty milliamper radiatior type Coolidge tube. In the case of the direct current machine a hospital type transformer may be used.

Dr. Willis F. Manges courteously tendered the following information relative to the factors of exposure: A six-inch gap he considers better than a five-inch spark gap for head work at thirty inches distance. The smallest possible diaphragm or cone should be used to eliminate scattered rays. The question of whether the film holder rests against a back of wood or metal is important. Scattered rays come back more easily through wood than through metal and are conducive to fogging the film. Doctor Manges also points to the choice of a proper developing solution and recommends the use of the latest published formula furnished by the Eastman Kodak Company. The formula submitted by the Eastman Kodak Company, thanks to Mr. Millard B. Hodgson of that company, is the following, for tank development:

	Metric
Elon	42 grams
E. K. Co. Sulphite of	
Soda	2040 grams
Hydrochinon	185 grams
E. K. Co. Carbonate of	
Soda	1020 grams
Potassium Bromide	36 grams
Water to	22 liters

Eastman exposure folders were in some cases lined with lead foil; or a sheet of lead, fourteen by seventeen inches, was placed behind the exposure holder. While this procedure usually made for greater accentuation of bone detail in many roentgenograms of parts other than heads, apparently through absorption of secondary rays, it was felt that no appreciable advantage obtained in the case of the skull. Perhaps the cranial contents in some way act to preclude finest detail through the use of lead as compared to the detail obtained without the use of lead. The use of the Potter-Bucky diaphragm was found unquestionably conducive to the production of excellent roentgenograms; but the results, for the purpose of this enquiry, were not thought to be better to a degree at all commensurate with, or warranted by the additional cost and impracticability of the technique, and it was, therefore, discarded.

In the photographic development of the film it was found better to choose over rather than under development. A developer which produces a minimum of fog is especially useful in securing contrast. This contrast may be increased greatly by intensification with

the usual mercuric bichloride solution. Each film should be identified with a lead number attached during the exposure, and at the earliest convenient moment there should be marked on the film in white drawing ink, the

Name
Age
Sex
Height
Weight
Physical condition
Clinical diagnosis

This serves not only for future identification, but it also completes the record and assists greatly in the subsequent study of the case.

Light Box

In a laboratory where roentgen ray anthropometry is to be extensively practiced, it will be convenient to provide a light box, the glass of which lies in a horizontal plane. It is sufficient to use one of the pair of stereoscopic light boxes rested in the proper position on a table, the height of which table will be governed by whether the roentgenologist prefers to sit or to stand during study. If a special light box is to be devised, average ingenuity will dictate the design. The only recommendation to offer is that the ground glass surface be somewhat larger than the usual stereoscopic light box size, say twenty-four by twenty-four inches; and that the lamps be deeply set and the box well ventilated to guard against undue overheating.

ACCESSORY INSTRUMENTS

For accurate mensuration of linear diameters a centimeter rule, graduated in millimeters, should be available. A convenient length is thirty centimeters; and a second shorter rule, say fifteen centimeters in length, will also prove useful. Those expressly made for this inquiry were of transparent celluloid, one and five-tenths centimeters wide, two-tenths centimeters thick. It is thought that transparent rules, by the fact that the point measured underlies the superimposed graduation, allow of an accuracy in reading greater than can be derived from the use of opaque rules, when the reading must be taken slightly aslant. Of whatever material constructed, it is fundamentally imperative that the graduations of the rule be of maximum accuracy.

In addition to the rules, a straight edge, about thirty-five or forty centimeters, should be provided as a guide for pencil marking the roentgenograms. The measuring rules should not be used as straight edges.

Dividers, about fifteen centimeters long, with extra pencil and ink attachments, are essential.

In addition to the instruments mentioned a small drawing set and ordinary drawing materials, including ink, hard and soft pencils, Bristol board, cross section paper, tracing cloth, celluloid goniometers and allied accessories, can be used, depending upon the form of record it is desired to obtain; but these miscellaneous appurtenances will be required only as the needs and enthusiasm of the enquirer may recommend.

SUMMARY OF APPARATUS AND INSTRUMENTS

The apparatus and instruments required in roentgen ray anthropometry may be classed into three groups, as follows:

1. Required
2. Essential
3. Accessory.

The required group comprises—

1. Any standard roentgen ray transformer, tube stand and tube.
2. Some form of vertical head rest, for which a stereoscopic plate changer will serve admirably.
3. Apparatus for the precision correction of distortion incident to roentgen ray divergence, including precision bob, bob sliding support and x-ray divergence protractor.
4. Accurate rules.

The essential group comprises—

1. Horizontal light box.
2. Dividers.
3. Goniometer.

The accessory group includes—

1. Drawing instruments.
2. Drawing materials.
3. Miscellaneous adjuncts.

Thus, it will be observed, the apparatus imperatively demanded for this study is neither excessive nor complicated. The accessories may be augmented at the will of the roentgenologist so as to include the most diversified assortment.

PRECISION AND SIMPLICITY

Unless precision and simplicity be at all times observed, the results accruing from whatever study become increasingly valueless and react to suppress or even eradicate any newly tendered science. In roentgen ray anthropometry, ordinary expertness in roentgenography is the first necessary qualification; and this can be met by any careful roentgenologist. The additional instruments, including the bob, bracket and protractor, admit of theoretically perfect results; and their construction and use is so simple that in this inquiry the degree of precision obtained depends entirely upon the amount of care expended. The instruments are originated so that only reasonable care is

TABLE II.

1.	2.	3.	4.	5.	6.	7.	8.	9.
Test on white male skull.	Tube used (Coolidge)	A Focus	Approximate target-film distance	(a) Protractor reading of bob	(b) Roentgeno- graphic length of skull. Centimeters.	(a x b) Corrected length Centimeters	Measured length Centimeters	Difference
			Inches					
1	10 ma.	Fine	About 15	0.91	18.0	16.38	16.4	-.02
2	10 ma.	Fine	" 30	0.805	22.6	16.98	16.6	-.02
3	10 ma.	Fine	" 50	0.78	21.4	16.69	16.7	+.01
4	30 ma.	Fine	" 15	0.89	19.0	16.91	16.9	+.01
5	30 ma.	Fine	" 30	0.82	20.9	17.13	17.2	-.07
6	30 ma.	Fine	" 50	0.76	22.7	17.25	17.3	-.05
7	7 inch	Fine	" 20	0.865	20.1	17.38	17.4	-.02
8	7 inch	Fine	" 40	0.795	21.9	17.41	17.4	+.01
9	7 inch	Fine	" 60	0.75	23.9	17.42	17.5	-.09
10	7 inch	Medium	" 20	0.83	21.2	17.60	17.6	.00
11	7 inch	Medium	" 40	0.76	23.1	17.56	17.6	-.04
12	7 inch	Broad	" 20	0.805	22.2	17.97	17.9	-.03
13	7 inch	Broad	" 40	0.71	25.3	17.96	18.0	-.04

demand in their use; and with reasonable care, the accuracy of the results yielded by roentgen ray anthropometry far surpasses that obtained in ordinary anthropometry, notwithstanding that in the latter the standards are exceptionally stringent, requiring a degree of skill that can be acquired only through persistent and prolonged practice.

To illustrate the degree of accuracy of which roentgen ray anthropometry is capable, various skulls were measured for their maximum length, or greatest antero-posterior diameter of the vault, according to the instructions of the International Agreement for the unification of craniometric and cephalometric measurements, as described by Hrdlicka in his textbook on anthropometry, using the Hrdlicka standard spreading compass (*compas d'épaisseur*). These measures appear in column eight of Table II. The skulls were then roentgen rayed according to the technique described, using different Coolidge tubes for each exposure, as indicated in columns two and three, Table II; using roughly approximate target-film distances, as listed in column four, Table II. The purpose of the survey was to diversify the tube focus and target-film distance factors as much as possible. Column five gives the protractor reading of the roentgenographic silhouette of the precision bob. The reading, it will be noted, is expressed in two decimal places, and occasionally in three. Although the spacious markings permit of closer interpolation than half spaces, it is entirely unnecessary to attempt any more than whole numbers or whole numbers and halves. Column six shows the roentgenographic greatest length, antero-posteriorly, measured in centimeters and millimeters with a rule of tested accuracy. Column seven shows the corrected length obtained by multiplying the roentgenographic length by the protractor coefficient; that is, the products of columns five and six. In column nine the

difference between the corrected roentgenographic length and the length as obtained on the skull by anthropometric measure, is expressed in fractions of a centimeter. It will be observed that in no instance, in this series, did the difference amount to one millimeter; although the experimental error permitted by anthropologists in the measure of the dry skull is two millimeters.

Table III is reproduced from Table II, and shows the roentgenographic length corrected and reported in terms of centimeters and tenths, as is prescribed in roentgen ray anthropometry. The rule is that when the second decimal place as obtained by calculation is five or more, the first decimal place is augmented by one unit; and when the second decimal place is less than five,

the first decimal digit is used unchanged. By adopting this rule, columns seven and eight of Table II are reproduced as columns one and two of Table III, and it will be noticed that the corrected roentgenographic length of the skull in practically every case coincides with the actually measured; or, if it varies, the difference (in one case, one millimeter) is less than the allowable maximum recognized by anthropologists.

CALCULATION

Errors in calculation may be divided into two classes, balanced and unbalanced. The balanced errors are those that result from personal factors; and the unbalanced errors, those that result from the use of improperly calibrated and incorrect instruments. Balanced errors are difficult to elimi-

TABLE III.

1.	2.
(a x b)	
Roentgenographic	Measured length
Corrected length.	Centimeters.
Centimeters.	
16.4	16.4
16.6	16.6
16.7	16.7
16.9	16.9
17.1	17.2
17.3	17.3
17.4	17.4
17.4	17.4
17.4	17.4
17.6	17.6
17.6	17.6
17.9	17.9
18.0	18.0

nate, although they tend to become less and less as the roentgenologist develops increasingly greater skill in the enquiry. Unbalanced errors must be removed, or the results compensatingly corrected for them.

The numerical statement of a measure is accurate in proportion as it expresses the true value of the thing measured; and precise as it approaches an expression of the mean of a number of measures. Accuracy is, therefore, concerned only with balanced errors. It is possible for a numerical evaluation to be precise, yet at the same time erroneous.

The expressed reading should, therefore, be given in terms that are in keeping with the accuracy of the observation. In recording measures of length the results should be expressed in centimeters and tenths. Fractions of a millimeter convey a precision wholly beyond the accuracy of observation.

To obtain the various indices, and in the computation of roentgen ray anthropometric results generally, the simplest arithmetic is all that is required. One who is conversant with the "rule of three" is at once a master of the basis for calculation incident to roentgen ray anthropometry. (4) Several short cuts may be introduced such as the use of the slide rule, or a table of logarithms. These are left to the roentgenologist to choose, his previous extent of mathematical training serving as a guide. In conducting multiplications and divisions, certain short methods yield results sufficiently accurate for purposes of roentgen ray anthropometry. Thus, the operation of multiplication may be done in full as follows:

1 6 4 5 (Multiplicand)
<u>1 2 9 3 (Multiplier)</u>
4 9 3 5
1 4 8 0 5
3 2 9 0
<u>1 6 4 5</u>
2 1 2 6 9 8 5

In this calculation the 5 of 16.45 and the 3 of 12.93 are really useless figures that may be sacrificed without affecting the accuracy of the result. This multiplication may be abridged, as by the following method: Write the multiplicand. Reverse the order of the figures in the multiplier and write them directly below those of the multiplicand. Multiply as usual, excepting that the first (right-hand) figure of each partial product is obtained by multiplying the figure of the multiplicand by the one directly below it in the multiplier, mentally adding anything which should be carried from the multiplication of the preceding figure

of the multiplicand by this figure of the multiplier. Writing these partial products so that their right hand figures stand in a vertical column, they may then be added and the decimal point determined by inspection. Thus:

1 6 4 5 (Multiplicand)
<u>3 9 2 1 (Multiplier, reversed)</u>
1 6 4 5
3 2 9
1 4 8
<u>4</u>
2 1 2 6

In order that this method may be better explained the example is again worked out as follows:

1 6 4 5
<u>3 9 2 1</u>
1 6 4 5
3 2 9 0
1 4 8 0 5
<u>4 9 3 5</u>
2 1 2 6 | x x x

Those figures that are to the right of the vertical line are omitted in the written calculation and simply mentally conducted.

In a similar manner a corresponding abridgment of long division may be effected by deleting a figure of the divisor in each partial division after the first instead of bringing down a cipher. For example:

1 6 4 5	2 1 2 6	(1 2 9 3
<u>1 6 4 5</u>		
4 8 1		
<u>3 2 9</u>		
1 5 2		
<u>1 4 8</u>		
4		
<u>4</u>		

This same division is worked out in full, showing the mental calculations that are eliminated, the figures to the right of the vertical line being the ones deleted:

1 6 4 5	2 1 2 6	(1 2 9 3
<u>1 6 4 5</u>		
4 8 1		
<u>3 2 9 0</u>		
1 5 2		
<u>1 4 8 0 5</u>		
4		
<u>4 9 3 5</u>		

The short methods indicated are not necessarily prescribed. They are offered only for the convenience of the investigator.

Having discussed the apparatus necessary in the technique of the in-

vestigation; introduced a method for correctly evaluating from the roentgenogram the true anatomic measure of the structures that appear projected upon it; presented the procedure necessary for the roentgen ray anthropometric study of the skull, and its accuracy clearly demonstrated; and discussed the mathematics of the investigation, there will now be submitted a system of roentgen ray anthropometry.

METHOD OF INVESTIGATION

Just as physical anthropology and anthropometry are essentially concerned with the study of man's variation, dealing in a comparative way with the study of the human body and its inseparable functions, so, too, is roentgen ray anthropology and anthropometry interested in establishing the comparative element in relation to general human anatomy and physiology, and general biology. Therefore, the method of study in roentgen ray anthropometry must be similar to that adopted by the physical anthropologist. The investigation should be conducted upon the unit of "a series" of cases; the anthropometric data derived from a single case being infinitely less valuable than that derived from a large number of cases.

The roentgen ray anthropometrist having practiced the accredited roentgen ray anthropometric methods and acquired the necessary degree of accuracy is next concerned with the collection of roentgen ray anthropometric material. Proper blanks should, therefore be provided upon which may be catalogued the necessary information and identification of the roentgenograms to be studied. The forms of these blanks are compiled to meet the needs of each roentgen ray anthropometrist. In their proper place replicas of the forms elaborated in connection with their original survey will be included for guides to those who may desire to begin or to continue roentgen ray anthropometric studies.

Before the roentgen ray anthropometrist proceeds in this study it is necessary that he should first qualify in general anthropological literature. By acquiring a knowledge of general anthropology and anthropometry many of the discussions to be presented in this thesis will be more lucid and lucient to the reader; so that a proper introduction to the study should include at least a reading knowledge of Darwin's "Descent of Man," "Origin of Species" and "Variation of Animals and Plants under Domestication"; Vernor's "Variation in Animals and Plants"; Haeckel's "The Evolution of Man"; Marett's "Anthropology"; E. B. Tylor's "Anthropology"; de

Quatrefages' "The Human Species"; Topinard's "Elements D'Anthropologie Generale"; Hrdlicka's "Physical Anthropology", and by the same author "Anthropometry." The references mentioned are only some of the innumerable important anthropological

treatises; but a familiarity with these few will serve as an excellent foundation in the light of which roentgen ray anthropometry may be intelligently appreciated and applied.

FOOTNOTES

1—Under the directions of the Smith-

sonian Institute.

2—Figures 207 and 208, page 149.

3—The part to be rayed must be placed as nearly as possible against the plate or film.

4—"Rule of Three":—2 : 4 :: 6 : x.
Simple proportion.

To be Continued in the July Journal

ROENTGEN RAY ANTHROPOLOGY (Sex Character of the Cranium)

NO. 1

CHARACTERISTIC	Value					
SIZE:						
very small	1					
small	2					
intermediate	3					
large	4					
very large	5					
SMOOTHNESS:						
very smooth	1					
smooth	2					
intermediate	3					
rough	4					
very rough	5					
SUPRA-ORBITAL RIDGES:						
trace	1					
slight	2					
moderate	3					
medium	4					
pronounced	5					
excessive	6					
MASTOID PROCESS:						
small	1					
moderate	2					
medium	3					
large	4					
excessive	5					
ZYGOMATA:						
slender	1					
moderate	2					
medium	3					
strong	4					
massive	5					
LOWER JAW:						
very obtuse	1					
obtuse	2					
intermediate	3					
acute	4					
very acute	5					
LOVER JAW:						
very low	1					
low	2					
intermediate	3					
high	4					
very high	5					
Total sum of character values						
Name						
Age						
Sex						
Height						
Weight						
Physical condition						
Clinical Diagnosis						

Standardization of Dosage Factors*

H. J. ULLMANN, M. D.
Santa Barbara, Calif.

WHEN visiting the average laboratory one cannot help noticing the carelessness and inaccuracy with which the factors governing roentgen ray dosage are measured and recorded. One operator will take the reading of a so-called spark gap meter which is simply a voltmeter on the primary circuit, and record it as the gap used without at the same time stating what rheostat setting was used. He probably never realizes that the reading represents a different gap for nearly every setting, and also varies with the milliamperage flowing through the line. Another will set his gap, which may consist of anything from a fairly sharp point to one so blunt that it is nearly a small sphere so far as the action on the spark is concerned, and then change from setting to setting until a spark occurs. Another may not be satisfied until he has a flame between the points. Still another will make a setting and then, with the machine running, pull or push the terminals together until a spark jumps, recording that distance as the gap. Another will use a setting which at some time in the distant past gave a spark of a certain length without realizing that a given setting may result in different voltages under varying conditions of load, primary line voltage, etc. These varying methods of estimating gap effect the relationship of gap to actual voltage profoundly and yet every one of these operators will feel that he is using a definite standard. When he has established his gap the operator will then set his filament control so that the milliammeter is reading a certain load to his satisfaction and that amount is recorded. If his meter is showing five, and one asks what the tube is carrying, he will look surprised and reply, "Why, five, of course." And yet, if the tube is disconnected and the switch closed the meter may read anywhere from a tenth of a milliamper to two milliamperes depending on the voltage, and this amount must be deducted from the reading with the tube in circuit before the actual amount producing radiation can be estimated. Is it not possible that much of the variation in effects found by different workers supposedly using equal dosage factors is due to actual variations in the factors themselves, that is, inaccurate measurement

or differences in nomenclature?

Let us first consider what these factors are and then take up the question of measurement separately for each factor. All of these factors are not subject to serious error in practice and the discussion is limited to such as are. For this discussion only the physical factors will be considered since the biological factors, such as skin reaction, radiation sickness, effects on the blood and other tissues, cannot be accurately determined until the physical factors are definitely established. Unfortunately, much of the work on the reaction of tissue to radiation has been done with poorly controlled physical measurements and there are experiments described which would be impossible to duplicate from the data given. It is doubted if the experimenters themselves could exactly reproduce the conditions described by them.

The physical factors involved in applying a given quality and quantity of radiation to a given amount of tissue are: For quality, *first*, the voltage applied and maintained at the tube terminals; *second*, the filtering material and its amount placed between the source of radiation and the irradiated object. For quantity, *first*, the voltage applied and maintained at the tube terminals; *second*, the volume or rate of current flow through the tube; *third*, the time during which this rate of flow is maintained; *fourth*, the distance between the source of radiation, the focal spot, and the substance being irradiated; *fifth*, the size of the area being irradiated; *sixth*, the filtering material and its amount between the source and the object irradiated.

Of all these factors the one of the two affecting both quality and quantity—the voltage—is the most carelessly measured. It is not only carelessly measured, but there are two meanings for the same term voltage as used in roentgenotherapeutic literature today. To make matters worse, another method of estimating and recording quality of radiation is usually used, in fact it is the oldest method and has the authority of age. This method is that of the parallel spark gap and is generally recorded as "gap" without qualification as to what kind of a gap is meant. Lately it has been customary to add "between blunt points" to the word "gap." How blunt these points are or how the gap was tested, that is, by meter reading, by setting and testing

or by moving the gap while the tube was running, is left to the imagination. About two years ago the writer, in order to find out just how great the error was in estimating voltage by these methods, tested a number of machines with a standard gap, the method adopted by the American Institute of Electrical Engineers for measuring high voltages. The results were startling. A variation from thirty-two per cent above the supposed voltage to twenty-four per cent below was found. Six machines were tested. The results and conclusions were published in the *American Journal of Roentgenology* for April, 1921. As the method and the comparison of accuracy between the sphere and point gaps were covered in that paper they will not be repeated here. Since that time other machines have been tested in Chicago, Los Angeles and Santa Barbara, California. This supplementary data only emphasizes the contention that the use of the point gap, spark meter or voltmeter on the primary as usually used to measure the voltage at the tube is grossly inaccurate. The following table was compiled from some of the observations made on different machines, both in Chicago and Los Angeles.

The figures above the line in each case represent the gap in inches between blunt points, or those which were recorded by the operator as such, and the figures immediately beneath are the peak or maximum kilovolts as measured at the tube terminals with a standard sphere gap. The different figures are the result of observations made on different machines.

6-inch	6¾-inch	8-inch	9-inch
83		110	120
85	85	120	124
90		131	124
92		131	125
99			127
			127

It is easily seen from these figures that one attempting to regulate his dosage by the old gap method might give an overdose as high as thirty-seven per cent or as much as fourteen per cent lower than he intended when using a six inches gap, with an eight inch gap from twenty per cent over to six per cent under and with a nine inch six per cent variation in either direction.

Unfortunately, if we agreed to use the definite term voltage instead of the ambiguous spark gap in defining this

*—Read at the Annual Meeting of The Radiological Society of North American, Chicago, Dec. 2, 1921.

particular dosage factor we would still cause confusion unless we stated whether the kilovolts were the peak or maximum or whether the effective or root-mean-square voltage was meant. The writer, within the last few months, has heard one essayist state that he was using a certain gap which represented so many kilovolts and a few minutes later another make the equally positive statement that the same gap represented a voltage nearly one and a half times as much. A little calculation showed that they both were using the same voltage factor, but were giving different meanings to the term kilovolts. One meant by kilovolts the effective, the other the peak or maximum. If the first had said that he was using one hundred kv. effective and the other one hundred and forty kv. peak there could have been no misunderstanding.

When the first reports of the German technique were published in this country one often heard that they were using one hundred and forty to one hundred and fifty thousand volts while our best was about one hundred thousand. It was soon shown, however, that their one hundred and forty was equal to our one hundred, because we were in the habit of using the effective voltage term while they used the peak. At this point it may well be asked what the essential difference is and why either rating cannot be used provided it is followed by the qualifying adjective "effective" or "peak"? There are two good reasons of which the second is the most important. First—where two terms are used interchangeably for the same thing, each requiring a qualifying adjective, that adjective will be frequently used with resulting confusion as to just what the author meant. The second and most important reason requires a little discussion. It has been established that the composition of the ray bundle from a tube excited by a pulsating or alternating current is dependent on the maximum or peak voltage reached at each current pulsation, other factors being equal. Therefore, it is essential to know for purposes of comparison or standardization, the maximum or peak voltage applied and maintained at the tube terminals. The distance a spark will jump between points or spheres, all other factors being equal, is dependent on this maximum voltage. The peak voltage is, therefore, the voltage measured by a spark gap. In engineering practice a gap may be calibrated for effective voltage, as the effective or root-mean-square voltage is that generally used by engineers. Engineers assume that power line alterations are in the form of pure

sine waves, in which case the relationship of the effective to the peak voltage is a constant—1 to 1.414. The engineer needs to know the effective or average voltage because the power developed in electrical machinery depends on this value, and not on the peak. The value of insulation, however, depends on the peak voltage. We may be receiving a pure sine wave in the primary of our transformer, but what is it after stepping up and rectification? Suppose we are getting such a wave, the relation is then 1 to 1.414, but suppose that instead of a pure sine wave leaving the transformer it is a semi-ellipse, the ratio then becomes 1 to 1.22, if an inverse sine 1 to 2.10, or if an inverse ellipse 1 to 3.23. If the wave is from an induction coil or contains harmonics the ratio will vary still more. If we measure the effective voltage by means of an electrostatic voltmeter or a meter on the primary and record it as being one hundred kilovolts effective in the report of a certain treatment the following errors in duplicating the dosage by another operator may result. Assume that the other operator wishes to use the same voltage and is to use a spark gap, which measures the peak, as his measuring instrument. Let us also assume that it is calibrated in effective kilovolts. If both transformers deliver a pure sine wave he will be using the same voltage as the first operator. If the first operator's machine while receiving such a wave at the primary was delivering an inverse sine wave at the tube he was actually applying two hundred and ten thousand peak volts at the tube terminals. If the second machine was delivering a sine wave the second operator would be applying one hundred and forty-one thousand four hundred peak volts at the tube terminals although both would record the voltage or gap as the same. These comparisons could be carried on indefinitely for every imaginable combination of conditions. Why, then, if the sphere gap measures the peak or maximum voltage and has been accepted as the most accurate practicable method of high voltage measurement by the American Institute of Electrical Engineers, and as the average quality of the ray bundle from an x-ray tube depends on the peak voltage, should we use any other term than the maximum or peak voltage when recording the E. M. F. in our records? It would be a great step in the standardization of dosage and the correlation of results obtained in different laboratories if the voltage factor were always measured by a standard, accurate method and recorded as kvp.—kilovolts peak, and the inaccurate "inches gap" never mentioned.

The second factor affecting both the quality and quantity of radiation—the filter—will only be taken up briefly, as it has been thoroughly discussed in the literature during the past year. There is one point, however, that seems to be seldom considered, the scattering factor. For example, it has been stated that X mm. of Cu is the equal in filtering power of 18 mm. of Al. This statement is based on the assumption that these respective thicknesses will stop A per cent of all waves longer than N Å. Assuming this to be the case and a wave of such length be used that ninety-five per cent is absorbed by X mm. of Cu and that this thickness be such that, for purposes of comparison, the scattering is negligible, it may then be assumed that five per cent of the total radiation will reach the patient. Suppose that 18 X mm. of Al be substituted for the Cu. While the scattering per unit of thickness of Al is less than that of Cu the great difference in thickness of the Al will result in so much scattering that little or none of the five per cent which would be passed if there were no scattering will reach its object. From this it will be seen that the greater the density of the filtering material the more efficient it becomes because of the lessened thickness required to obtain the desired filtration. Provided that the density is within that limit which gives proportionally greater absorption of the long wave lengths. It is therefore dangerous to assume that, because an operator reports an hour treatment through ten mm. of Al that the same time can be given when the filter consists of 0.5 mm. of Cu and one mm. of Al. In the second case the patient, while getting roughly the same quality, is actually getting a greater quantity of radiation.

The first factor affecting quantity is the voltage, and has been discussed in the preceding paragraphs. The second—volume or rate of current flow—may seem to require little discussion, as its method of measurement has always been the same. It is desired, however, to call attention to serious sources of error, one of which was mentioned in the opening paragraphs. There are in practice two definite sources of error. First—Error in meter calibration; and second, leakage in the high tension circuit. If these possibilities are recognized they may be easily guarded against and remedied. Any meter may, after a varying time (and it usually does) change its reading for a given load. A change of forty per cent may be met with and smaller percentages are common. To guard against these meter changes it is only necessary to have three meters, one in reserve and two in the high tension circuit. It is

mann if he had been experienced with osteomyelitis.

assured, of course, that only the highest grade of meter is under consideration. When the two meters in the circuit cease to read exactly alike the reserve meter is put into the circuit and the meter failing to check with the new meter is returned to the maker for adjustment and recalibration. Leakage in the line may be detected in two ways, by closing the switch with the filament current off and noticing the meter reading, or by cutting a meter in at one tube terminal and noting the difference between the reading there and at the machine. The leakage known for any given voltage, the current can be increased proportionally until the tube is passing the amount desired. For example: If the loss by leakage is found to be one milliamperes the reading must be six to have five milliamperes passing through the tube.

The writer has been quoted as suggesting or advocating a sphere gap as a standard in voltage measurement. This is a misunderstanding. The suggestion was that a definite unit for recording the potential be adopted, a unit which has been standardized and about which there can be no misunderstanding in regard to the meaning. That unit is the volt and its multiple the kilovolt. The decision regarding the best method of measuring the voltage must be left to the physicists and electrical engineers. The sphere gap was used in making the tests described because it has been adopted by engineers as the most practicable method for measuring the peak value of high voltages in use today and also has the advantage of being an accepted standard.

The writer wishes to emphasize the necessity that a sphere gap must not be simply two spheres held by supports, one of which is movable, set on an ornate base with various tables of calibration, but must comply, in its every dimension and detail of construction to the standardization rules of the American Institute of Electrical Engineers. If it does not it will not measure voltage any better than the old, so-called point gap.

CONCLUSIONS

1. That the methods commonly used in practice to measure the physical factors of an x-ray dose are grossly inaccurate.

2. That much or most of the work being done on the biological effect of radiation is either valueless or must be repeated with properly controlled physical measurements before differing results can be correlated. This applies even more strongly to clinical observations.

3. That many variations in effects reported by different observers would probably cease to exist if their physical factors, within reasonable limits, were the same.

4. That when roentgenologists realize these facts and adopt uniform methods of measuring and recording, the records and observations will increase in value in proportion to their uniformity, and when sufficient accurate data has accumulated it will be found that many of the discrepancies reported by different workers will cease to exist.

DISCUSSION

DR. E. C. ERNST (*St. Louis, Mo.*): I believe all of us will feel there are many things to be taken care of in giving the ordinary therapy doses. If we have learned nothing else, perhaps when we go back we will make every effort to follow all of these doses.

It is unnecessary for us to be physicists to do so.

Of course, to be absolutely certain of what we are doing, the sphere gap is very essential. Just the small details are necessary in order to really give the lethal dose to the deeper tissue. For example, in the last six weeks I saw two radiologists working and copying one of the famous European techniques and they were using one hour, and one hour and a quarter exposures, using a millimeter of copper. In one instance they were using a distance of fifty centimeters and one of seventy-five. What were they getting beneath the tissues? Perhaps one-twentieth of the normal dose. Those are important things if we are going to follow and really produce the radiation within the deeper structures.

A number of the members asked me to again repeat a method of protecting the patient. The time was too short yesterday to bring that out. I have been following a simple method of using a switch. (I believe the description was published in *The Journal of Radiology*) a simple knife switch in the radiological room, having a large handle. To this knife switch is attached a string. This string is attached to the finger of the patient, tied around the forefinger. I sometimes use a thimble. The object of this switch is to turn off the primary circuit.

The patient cannot turn the hand without pulling the switch. You can blow on top of the wood extension and open it. Just the slightest pull opens it. The slightest move of the patient pulls the switch, turns off all of the current. I do not know of anything that will effect it mechanically. The patient cannot make much of a movement, cannot scratch her head or anything to get in close proximity to one of those wires unless she pulls that switch.



EDITORIAL

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Dr. Heber Robarts and Radiology

WHEN news of Dr. Heber Robarts' death was received, a very positive and clear succession of ideas was set in motion. Dr. Robarts, it will be remembered, was one of the charter and conspicuous members of the Radiological Society of North America and the American Roentgen Ray Society—conspicuous, not so much for his words as for his deeds. And now that his life has become his tribute to the science of radiology, the thought cannot be denied that there is a definite obligation on the part of each member of this and every other organization professing interest in the science, an obligation to actually do something tangible toward the prevention of such catastrophic sacrifice by men seriously attacking some of the imperious problems of radiology.

It is not for the purpose of memorializing Dr. Heber Robarts that these lines are written. His is a living memorial of deeds. Far better testimonial than anything which might be devised of the flimsy words which constitute human speech are his achievements in, and devotion to the science which finally snuffed out his life and ended many years of suffering borne with unexampled fortitude.

Dr. Robarts caught the vision of the science of radiology while it was in its infancy. He personified his belief in its potentialities by following and enlarging that science steadfastly until the day of his demise. And it is one of life's mockeries that this stalwart man should be stricken just at the moment when the child of his dreams is passing through adolescence. This is especially unfortunate because Dr. Robarts perceived very keenly those latent powers which all thoughtful Radiologists see limned on the horizon of this therapeutic agent.

Mindful of the price Dr. Robarts has paid, and paid gladly in order that suffering humanity might find alleviation for some of its direst ills, it is perhaps fitting something be said concerning the obligation each and every member of the Radiological Society, and every other person who professes more than a playful interest in the science of radiology, should assume fearlessly and without cavil in an effort to co-ordinate and correlate scientific research in the United States insofar as it has any bearing on this field of endeavor.

It hardly seems possible, however, that serious practitioners of radiology, especially those working on the therapeutic side, whether in a desultory fashion or serious way, will question the fact that the greatest achievement which must be accomplished before that science can demand the complete respect of intelligent men, is the correlation and

co-ordination of the clinical and physical problems involved in its application as a curative power.

The therapeutic value of any science is the acid test by which it is gauged as either a medical or social agent. As things now stand, radiological practitioners must attempt to meet the clinical requirements of their practice with a very limited, and at best, poorly formed knowledge of the physical factors involved. The average practicing radiologist knows comparatively nothing about the physical side of the science he employs—yet the fundamental laws of physics are unquestionably important factors whose intelligent conception and use determine the character of therapeutic possibilities in either experimental or applied radiology.

Perhaps this abstraction merits some detailed consideration for the benefit of the reader who has not thought about this matter seriously, or who has been unable to reach a satisfactory and safe conclusion with respect to the failures registered altogether too frequently for comfort. Much confusion on the subject has resulted through an empirical medical training received before the science of radiology was known at all, or at a time when that science was looked upon as nothing more than a new phase of photographic art.

Make no mistake. No brief is held for the view that a thorough knowledge of physics is all that is required to fit a man for the intelligent practice of radiology. Nor is it contended for a single instant that a more or less complete knowledge of medicine with due cognizance of its clinical aspects is all one needs. Rather, the thought which is sought to be established beyond the point of controversy is, that the science of radiology embraces both sciences—medicine and physics—and that the former provides the yard-stick by which the latter must measure its achievements insofar as therapeutic values are concerned.

Emphasis is sought, also, to be placed on the fact that the study of physics has been, and still is, in very large degree, conducted by our institutions of higher learning along engineering and industrial lines rather than medical or therapeutic lines. And it must be conceded by every fair-minded person that a wholly different field is involved in the former than in the latter.

From all of which it would seem but the part of common sense to say, that if the physical problems which at present demand solution before the science of radiology can move on to its next development therapeutically, are ever to be approached and studied through with advantage, either to the medical profession or to the physicists of the world interested in human welfare, those medical men most interested in their solution must bring to the research worker in the purely physical field a clear and concise conception of the clinical phases of each problem to be attacked.

Because the clinician and the physicist have met on common ground, each with an open mind and a definite realization of the fact that alone he could never bring to his science the utmost in achievement, is the reason why radiology in Germany has for many years drawn hundreds of America's foremost practitioners to that country for observation, for study, and for instruction. Stated baldly, the correlation and co-ordination of their research work, with its acknowledged results, has been the lodestone by which the German scientists have commanded the admiration and blind hero-worship of American medical men.

This statement is not made with any thought of aspersions. Quite the contrary. It must be agreed that it is im-

His Life His Tribute

possible to admit the fact which has just been acknowledged, a fact medical men have conceded by frequent excursions to Germany, without paying some deference to the vision and scientific acumen which has actually made all German scientists co-laborers with a common purpose and common objective, the public health.

In passing, it seems only fair to say that American scientists have enjoyed equal if not superior opportunity. This is exemplified by the fact that an American, W. D. Coolidge, conceived and perfected the tube which bears his name and which made possible the practical and beneficent application of x-rays. Without that tube, or some adaptation of the principles it applies, the development of radiology in Germany, or any other country for that matter, could never have reached its present state of eminence.

All which leads unmistakably to the conclusion that the medical profession of America, especially that part of it engaged in the science of radiology, has been excusably derelict in the performance of a duty which could not be performed by any other class or creed. That is a pretty harsh statement, and one which will undoubtedly incite a good many heated arguments. There is nothing quite so discomfiting and given to the breeding of distemper as the pointing out of one's sins, whether of omission or commission. But the fact remains. No honest man will deny it. He will, however, if he believes in himself and in his science, set about to fill the hiatus.

That brings us back again to such men as Dr. Robarts. That was the self-imposed job undertaken by him. That same job has been undertaken by other great and self-sacrificing men, and they, too, with him, have paid life tribute. Doubtless other zealous souls will pay a similar price for their ambitious scientific endeavors before the science of radiology is firmly established on an intelligent and scholarly basis, where the combined wisdom of all the sciences of which it is the culmination is applied in safeguarding the lives of its devotees, and in developing its therapeutic applicability to the ultimate.

conducted by our institutions of higher learning along engineering and industrial lines rather than medical or therapeuticium, an armamentarium which contains greater unknown potentialities than that of any other curative agent, radiologists themselves are so certain of the future of their science that they have invested and continue to invest, sums of money ranging from \$25,000 to \$75,000 in laboratory apparatus and equipment and incalculable time and energy. That, too, without knowing, or having set in motion such orderly procedure as gives assurance they will some day know, how to apply that science intelligently and use such large investments efficiently. Is it disrespectful or unsentific, or even unprofessional, to suggest that such a situation presents something of an ironical exposition of Patrick Henry's famous edict "Millions for defense, but not one cent for tribute?"

Many other thoughts surge through one's mind in the serious contemplation of this condition. However they are in large measure merely incidental phases of the one outstanding proposition that the science of Radiology can never answer fully the demands made upon it by suffering humanity, and radiologists themselves can never attain a state of professional respectability and public confidence, until the job of co-ordinating and correlating the clinical and physical phases of the science has been seriously undertaken.

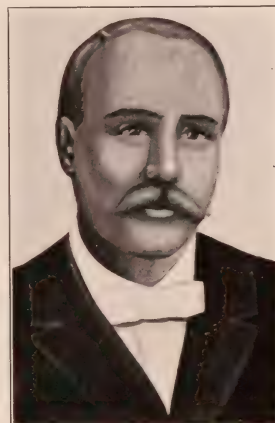
That is why the members of the Radiological Society should constantly find in the chair so lately made vacant by Dr. Robarts' death, that mute evidence of sacrifice, scientific devotion and incomparable fealty which should stimulate them to great achievement and constructive purpose, and in comparison, render a money contribution to a perpetual working organization designed to supply the fundamental requirements indicated, seem like a paltry thing indeed.

NO less in the field of science than in the field of religion is it true—and in no mystic sense in either one—that the blood of the martyrs is the seed of life more abundant, making the desert blossom with beauty where before was hideousness.

Of none of these martyrs is it more true that dying they yet live than of those who have literally given their lives in searching out the laws of the science of radiology.

Dr. Heber Robarts, charter member of the American Roentgen Ray Society, and upon whom the Radiological Society of North America conferred the honorary degree in 1919, is the most recent one of those whose tragic yet sublime death causes us to lift our heads once more in thrilled admiration, and then to quickly bow them in awed realization of the grandeur of his living and dying.

More than twenty years ago Dr. Robarts began experimenting with radioactive substances and was one of the first men to make use of radiotherapy, when the path along which he traveled was yet dark. In groping his way along to the present early morning light he sacrificed first, the middle finger of the left hand, then the index finger of that hand, and a few years later the same fingers of the other hand.



After the last operation a cancerous condition developed in the right arm, finally metastasizing into the shoulder and chest, and terminating in his very recent death.

As soon after this last amputation as his condition became apparent, he went to a New York hospital, and later to Baltimore for treatment, where he found that his own methods were the ones in use. Returning home, he put himself into the hands of his own confreres, directing their handling of his case and being treated with his own radium.

Three weeks before his death he decided that the end was not far distant. He gave his final instructions regarding his personal affairs, and, true to his burning zeal for his profession, directed that a postmortem be held in the interests of science. To mitigate his great suffering he prescribed sedatives for himself, remaining in a conscious condition, however, until half an hour before he quietly slipped away.

Dr. Robarts was born at Godfrey, Ill., seventy years ago. He received his training at McKendree College, Illinois University, and had taken post-graduate work in the east and abroad. He practiced in St. Louis until 1904, when he removed to Belleville, Ill.

He was president of the Southern Illinois Medical Association, a member of the Roentgen Society of London, of the American Medical Association, the St. Louis Academy of Sciences, the St. Louis Medical Society and the Missouri Medical Society, as well as a member of the American Roentgen Ray Society and the Radiological Society of North America.

Canadian Consultation Bureau

The Canadian Radiological Society begs to announce to the profession of Canada that the society has established a consultation bureau, where any and all questions pertaining to x-ray and radium may be submitted for information, suggestions or advice.

One of the chief objects of the society is the maintaining of a thoroughly ethical standard throughout Canada in this special branch of medicine, and providing practical assistance toward that end. This is being done cheerfully and entirely without charge, and in doing so it is, of course, obvious that there is no mercenary motive whatsoever. The idea underlying the establishment of this bureau is that the members of the society, being specialists in this branch, are best able to assist in these matters. So, therefore, whether it be the selection of apparatus, difficulties in operation, or other points of a technical nature or otherwise, the resources of the society are being offered for the asking.

It is hoped that the profession will accept this offer as it is meant, and we assure you that we will be very glad to be allowed to assist you in this way.

Fraternally yours,

L. K. POYNTZ, Secretary-Treasurer.

Canadian Radiological Society

The third annual convention of the Canadian Radiological Society is being held in conjunction with the meeting of the Dominion Medical Association in Winnipeg, June

20, 21, 22, and 23, and I am instructed by the president to extend to the officers and members of the Radiological Society of North America a sincerely cordial invitation to be present at that time.

At our last convention we were honored by the presence of a very representative body of distinguished members of your society, and we will look forward to welcoming them and others at the Winnipeg meeting.

It is requested that those gentlemen who contemplate attending the convention communicate with the secretary at their earliest convenience.

L. K. POYNTZ, Secretary-Treasurer.

The cordiality shown in the above announcement is only a slight indication of what will be experienced by those who can attend the meeting. Our brothers across the border to the north have shown such loyal and enthusiastic support of all progressive efforts in radiology that we of the states owe them a debt which can never be paid. We can show our appreciation in a small way by attending the annual meeting of the Canadian Radiological Society at Winnipeg, June 20-23. Plan now to go. Combine this trip with your vacation if you wish.

Radium Theft

It may be of some interest to the readers of this Journal, especially to those interested in radium, to know that we have recently lost fifty-five milligrams of radium (four needles and one five milligram plaque) through theft. It was taken from a locked, combination safe. Fifty milligrams in two tubes in an applicator were overlooked by the thief, which probably points to his ignorance of radium. It is possible that this thief may apply to some physician for treatment of a radium burn and so be apprehended. Certain evidence connected with the theft seems to point to an organized gang of radium thieves going about the country.

ALBERT M. COLE, M. D., Indianapolis, Ind.



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CASE REPORTS

Benign Spastic Stricture of Sigmoid

SPASMODIC stricture of the lower bowel, particularly of the sigmoid and rectum, has been much discussed, the majority of observers believing that spasmodic narrowing associated with true muscular hypertrophy never occurs. The following case report should therefore be of interest.

Mr. J. B., aged sixty-two, entered the Methodist Hospital of Indianapolis December 9, 1921, on the service of Dr. H. K. Turner. He complained of constipation beginning three months previously, two to seven days elapsing between bowel movements. Upon entrance, a week had passed without a bowel movement. Vomiting had occurred several times, especially after taking cathartics. He had lost fifteen pounds in weight. No other pertinent information was elicited.

He was apparently in no discomfort. Temperature, ninety-five degrees; pulse, ninety-two; respiration, twenty-six. Important findings were: abdomen distended, tympanitic, slightly rigid

throughout, with no palpable masses; prostate hard, although not markedly enlarged.

Fluoroscopy of the barium enema December 10th showed delay in the upper rectum with considerable ballooning here before the sigmoid filled. As the remainder of the colon slowly filled, there was noted in the lower sigmoid a narrowing of the lumen about two inches long, apparently smooth in outline. This then diminished to the size shown in the radiograph here reproduced. The sigmoid was redundant, but not dilated. On account of the typical fluoroscopic appearance above described, our interpretation was spasm. A palpable mass in the left hypochondrium appeared to be extra-colonic, presumably in the small bowel. This remained unexplained, but probably was due to obstruction.

Fair movements followed this, but nausea, vomiting and distention persisted. The surgical service considered the lesion carcinoma, with the patient

in inoperable condition. Further x-ray study with antispasmodics was precluded by his poor condition, but fluoroscopy December 15th, showed a greatly dilated cecum full of barium from the previous examination. The usual laboratory tests gave no further information. Patient died December 16th.

Dr. J. H. Warvel, the hospital pathologist, reported autopsy findings in part as follows: Gross and microscopic changes in the middle jejunum indicated beginning gangrene. No evidence of embolus was found in the nutrient vessels. The sigmoid about six inches above the anus appeared thickened and the longitudinal striations rather marked, the bowel here being patent. Microscopically, the sigmoid was normal except for thickening of the muscular coat. An abscess about one cm. in diameter was present on the inferior surface of the liver. Coronary sclerosis, chronic myocarditis and chronic interstitial nephritis were noted. The gall-bladder appeared normal. The appendix was small, six and one-half inches long, bound down posterior to the cecum and without apparent inflammation. The prostate was enlarged and the lateral lobes irregular in outline.

Possibly the fatal outcome here is attributable to mesenteric vascular occlusion, caused by factors not disclosed at autopsy. Much greater interest attaches to the spasmodic stricture first detected by roentgenoscopy and later confirmed at autopsy. It is important to note that neither history nor post-mortem findings suggest old ulcer or fistula which might have caused local spasm followed by muscular hypertrophy. Reflex from the appendix should, however, be considered.

Hertz⁽¹⁾ discusses enterospasm of possibly similar type, with bibliography. Howship first described it in 1830, since when Cherchewsky (1883), Fleiner (1893), Mahieu and Roux (1905, 1908), and Hawkins (1906) have discussed it, some of them under the name of spastic constipation. Hertz does not mention roentgen examination of the lesion. He considers it an exaggerated reflex, due probably in most cases to hard feces, retention of which has usually resulted from ordinary neurasthenic constipation.



Ball ⁽²⁾ and Earle ⁽³⁾ doubt the existence of such enterospasm without local irritation. Lynch ⁽⁴⁾ has never seen an undoubted instance. Case ⁽⁵⁾ mentions having seen colon spasm of possibly similar type. The only mention of similar muscular hypertrophy found comes to our attention as this is ready for publication. Ashhurst ⁽⁶⁾ reports removal of a similarly spastic recto-sigmoid under the diagnosis of carcinoma, in which the barium enema had shown a circular serrated filling defect.

The symptoms noted by Hertz have been constipation, a dull abdominal aching and often tenesmus. Vomiting is rare. Peristalsis is neither visible nor palpable, and there is no marked distention above the contraction. Rarely, as in Ashhurst's patient, there may be acute severe colic. Naturally, the stools contain no blood.

Colon spasm associated with some more or less definite local or reflex cause is not unusual. The lesion described is new in our experience. Attention is called to the value of roentgen evidence in such a lesion with confusing clinical signs.

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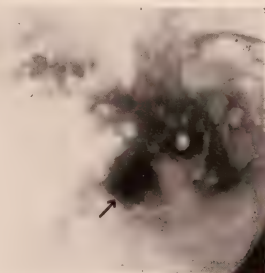
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Drs. Cole, Beeler and L. A. Smith, Indianapolis.

Glass in Brain

PATIENT: Age thirty years, male, white. While riding a bicycle patient was run down by an automobile. He was thrown upon the radiator, his head striking the headlight. Face was lacerated about the cheek and chin and there was a slight cut over the ear. After the wounds had been sutured and drainage established they seemed to be healing perfectly, when one morning, while dressing and making an examination of the wound, a pressure upon the temporal region caused the patient to fall to the floor, and it was some time before he regained consciousness. Patient was able to walk about, but he was very restless and his actions and speech were not normal.

Next day a radiograph was taken and showed a three-cornered foreign body and some loose fragments of shell, lying just above the external auditory



meatus. Upon operation a heavy piece of headlight glass one and one-fourth by one and one-half inches was found lying upon the dura mater. Glass and fragments of bone were removed and the wound sutured. Recovery was complete within two weeks.

Andrew W. Stevenson, M. D., and Robt. D. Wiswall, M. D., Vancouver, Wn.





ABSTRACTS and REVIEWS



Juvenile Deforming Osteochondritis, with Report of Cases. E. D. Fenner, M. D., New Orleans M. & S. J., April, 1922.

THE author presents a very excellent article on this interesting condition, described almost simultaneously, and independently by Legg, of Boston, Calve of France, Waldenström of Sweden and Perthes of Tübingen. Legg first published an account of the disease in February, 1910. The most interesting feature to radiologists is that, while the symptoms are so similar to tuberculosis of the hip, the radiographic appearances are conclusive and a definite diagnosis of deforming osteochondritis can be made from the x-ray image alone.

The author reports seven cases, one of which was bilateral. W. W. W.

Low Back Pain, A Clinical Study of Its Cause. John T. O'Ferrall, M. D., Jour. Bone and Joint Surgery, April, 1922.

THIS author reviews forty cases of lumbosacral pain with regard to: method of onset, location of pain, effect on spinal motion, and association of infectious foci elsewhere in the body.

He regards the pathology as a sprain of the lumbosacral ligaments, entirely analogous to a sprain of any other joint, and attaches very little importance to bony abnormalities, or to x-ray examination unless fracture is present.

He considers that a secondary infection is frequently superimposed and that eradication of infectious foci should be a part of the routine treatment and this treatment should be based on the principles which apply to sprains elsewhere. W. W. W.

A Study of Two Hundred and Eight Cases of Lower Back Pain. J. R. Kuth, M. D., Jour. Bone and Joint Surgery, April, 1922.

THIS study of two hundred and eight cases of lower back pain does not include cases of manifest injury or disease of the lower back structures. The series includes one hundred and thirty-six males and seventy-two females, ranging from twelve to seventy years in age. The etiologic factors determined were as follows: static factors, such as short leg, old fracture of lower extremity, foot deformity, obesity, marked cases of general weakness. Four cases of this group showed defi-

nite lipping of one side of the fifth lumbar body; sixty cases are included in this group.

There were twenty-seven cases where traumatic factors entered; symptoms followed falls, direct blows, or sudden strains from lifting.

There were thirty-three cases where infections entered; there were definite local and general symptoms of infection, or the symptoms followed cold and exposure, or there was definite x-ray evidence of osteoarthritic changes.

W. W. W.

Note on Sacralization of the Fifth Lumbar Vertebra. C. Thurston Holland, D. L., M. R. C. S., The University of Liverpool, Jour. Bone and Joint Surgery, April, 1922.

THE author briefly reviews the growth of interest in this interesting anomaly, and cites ten cases which have come to his attention during the year 1921. He summarizes the causes of the symptoms which are usually found in these cases, i. e., pains of various sorts centering in the lower back. These symptoms have been said to be due to (1) actual pressure on nerves or nerve trunks, (2) ligamentous strain, (3) compression of soft tissues between bony joints, (4) arthritis when a joint is present, (5) bursitis when a bursa is present.

W. W. W.

Causes of Back-Ache and Leg Pains.

John H. Galbraith, M. D. Pa. J. Roentgenol., April, 1922, p. 23.

PAIN is caused by some irritation of the nervous arc and nervous affections are divided into four groups, namely, (1) organic nervous diseases and cord lesions, (2) diseases of the abdominal and pelvic organs, (3) osseous lesions, and (4) ligamentous and muscular lesions.

The last two are of especial interest to the roentgenologist and with respect to these there must be considered under the heading of this paper the following lesions and conditions: tumors, infections, normal variations, anomalies, trauma, sacro-iliac affections, static derangements. Tension, pressure, stress and strain are factors producing pain with these lesions.

Secondary carcinoma closely resembles tuberculous lesions; early symptoms are obscure and deformity is late or absent, owing to the greater density and size of the vertebrae. The x-ray

findings may go from negative to gross findings in a very short period.

Syphilis of the vertebrae and sacrum comes more and more to notice, also chronic infectious spondylitis.

Acute suppurative disease of the lower back is rare but is sometimes found. The sacro-iliac region is more prone to this than other parts.

Focal infections, of which there are many possible sources are often accountable for the conditions under discussion.

Variations in size and shape of the different parts of the vertebrae and developmental anomalies present a great class of causes of back-ache and leg pains. Two types of back are presented; the long and slender one with long, narrow, individual vertebrae has wide intervening discs; the second type has shorter vertebrae with thin discs. Of the variations of different parts, deviations of the direction of the articular facets of the lumbar vertebrae are usually vertical but they may be crescentic or hook-shaped on one side or on both. Variations in size and shape of the transverse process of the fifth lumbar vertebrae may cause a bursa between it and the ilium or the top of the sacrum.

Archer O'Reilly of St. Louis recently published a report of the x-ray examination of three hundred cases of back-ache, with tracing for one hundred and ninety-nine of these. He divides the lumbosacral articulation into three definite types, with reference to the lumbosacral joints and the position of the sacrum with relation to the ilia and transverse processes of the fifth lumbar. There is a very wide variation in size, shape, and position here. The static disorders are closely associated with these variations for many of them give rise to faulty postures which in time cause stress and strain on the muscular and ligamentous structures.

Pain and tenderness of the fascia and ligaments of the feet may result from simple muscular insufficiency and the same thing occurs in the back.

Injuries to the fascia and ligaments are very slow in healing and this is the one important thing mentioned in regard to trauma.

The great bony lesion which may be present with only moderate disability, and the reverse conditions, are striking facts.

Sacro-iliac relaxation and so-called subluxations present a very interesting class of etiology. Chronic and acute sprains are two of the most common disorders. In all cases of pain in the leg or thigh with no local manifestation of disease the sacro-iliac joints should be thoroughly examined.

The Roentgen Examination of the Gastro-Intestinal Tract. Adolph Hartung, M. D. Illinois M. J., April, 1922, p. 258.

THE author's purpose is to give a comprehensive idea of the value of the roentgen examination in gastro-intestinal conditions and to point out the class of cases which especially call for this procedure.

Acute conditions usually contra-indicate giving an opaque meal, though very exceptionally roentgen diagnosis is necessary in these conditions, e. g., an abnormally located appendix may present a confusing symptomatology.

In a second group with unmistakable symptoms diagnosis may be made clinically. Nevertheless the roentgen examination is often of value here in showing associated lesions which have an important bearing upon the course to be pursued.

In a third group the cases are obscure and the true condition can be secured only by a combination of roentgen and laboratory findings plus clinical history.

As to technique, it is better that the same medium be constantly used for the suspension of barium sulphate (for the sake of comparative data) and this medium must have a food value if gastric stasis is the problem to be studied. Preliminary cathartics should not be given and the patient must come presenting an empty stomach for the examination. A mild, cleansing enema may be used to empty the colon before an opaque enema is given. This last is necessary if it is found impossible to obtain the information with the opaque meal first given. Three separate examinations should be made, one immediately, one six hours after the meal, and one twenty-four hours after the meal; additional ones may be necessary as well. The fluoroscope and plates, or films, should supplement each other.

A preliminary fluoroscopic examination of the chest and abdomen should be made, also one plate of the abdomen made to detect unsuspected lesions.

Beginning with the esophagus diverticula and strictures should be noted. Dysphagia, solid mediastinal tumors, aneurysms and abscesses associated with Pott's disease may be early differentiated.

The normal stomach shadow is hook-shaped in eighty per cent of cases, cow-horn shaped in ten to twenty per cent. The stomach's position is variable and its size dependent upon the volume of meal ingested. More important than these things is the manner of filling and the emptying time.

Gastric ulcers, if acute, may show no evidence. Chronic ulcers show the crater or filled up defect in the walls. Perforating ulcers, extended through the walls, show accessory sacs partly filled with the opaque meal and a bubble above this. Malignant ulcers frequently cannot be differentiated from simple ones, but if an ulcer is large it is suspicious. Attention is called to Carman's palpatory technique.

The filling defect is the important factor in diagnosis of gastric cancer, the lesion projecting into the lumen.

Emptying time varies greatly. The possibility of lues should always be considered.

Duodenal ulcers are more common than gastric ulcers. The acute form may give no indication of its presence, the chronic form will show filling irregularities and tenderness to pressure; these symptoms must be definite and constant to be used as a diagnostic basis. Duodenal diverticula are not infrequent.

The widely differing reports of percentages of gall stones demonstrated by the x-ray are probably due to differences of technique and to the class of cases examined. Definite information can be obtained in seventy-five per cent of gall-bladder troubles if proper technique is used.

As a rule pancreatic cysts and malignancies, hypernephromas, and retroperitoneal sarcomas can be demonstrated with proper care and technique.

Lesions of the small intestine are infrequently diagnosed by the roentgen examination. Obstruction and attendant stasis and Lane's kinks can be shown here.

The normal appendix may be visualized sometimes, after the six-hour examination, more easily by the fluoroscope than by plates. Signs of its pathology are abnormal fixation, localized tenderness to pressure, abnormally long retention and irregularity of its lumen.

What has been said of the position of the normal stomach applies likewise to that of the colon. Stasis here should be ascribed to ptosis only after all possible organic causes have been ruled out. Diverticula are more common here than formerly was thought to be the case and they may or may not cause symptoms. Cancer of the colon usually shows up as an irregular fill-

ing defect with a variable amount of obstruction.

Tuberculous lesions of the stomach cannot be roentgenographically differentiated from any other gastric ulcer, though associated pulmonary tuberculosis renders such a diagnosis more probable. Tuberculous peritonitis with plastic adhesions shows fairly characteristic findings.

Marginal and Jejunal Ulcers Following Gastro-Enterostomy. F. C. Scholdt, M. D., F. A. C. S. Minn. Med., April, 1922.

THE ulcer may be situated in three anatomical areas, namely: on the gastric side; on the suture line; in the proximal limb, distal limb or mesenteric border of the jejunum. They are usually single, though several cases of multiple ulcers have been reported. Roojen's five types of jejunal ulcer are these: (1) without symptoms which heal, (2) with pronounced local and general symptoms, (3) with acute perforation, (4) with tumefaction and inflammatory infiltration into the anterior abdominal walls, and (5) ulcers which develop jejuno-colic fistulae.

In one case, reported in detail, the x-ray findings were quite definite. There was a penetrating ulcer and a constant incisure on the lesser curvature opposite the ulcer.

The author discusses the etiological factors at some length, summarizing them into the following: (1) faulty technique in control of bleeding, (2) unneutralized acid chyme, (3) non-absorbable sutures for inner sutures, (4) too much clamping of tissues or a Murphy button, (5) infection.

W. W. W.

Maxillary Cysts. Fulton Risdon, M. B., D.D.S. Canadian Practitioner, April, 1922.

THESE cysts are here divided into two classes: those due to embryonic rests, and those due to preceding infection.

The diagnosis depends largely on the roentgenogram. Differentiation must be made from malignancy, lues, osteoma, fibroma, adenoma, adamantinoma, chondroma.

W. W. W.

Pneumo-Roentgenography of the Kidney. Am. J. Surgery, March, 1922, p. 75. (Excerpt from editorial.)

CARELLI of Buenos Aires evolved a much more accurate method (than palpation). Adopting the principle of pneumo-roentgenography *** he has applied it to perirenal inflation and has evolved a technique which, in his hands, is safe and harmless and

makes demonstrable the shadow of the kidney as clearly as does pneumoperitoneum the shadow of the liver and spleen. The injection is made with a needle close to the lateral process of the second lumbar vertebra. The technique must be very precise and carefully controlled by the manometer. Five hundred cc. of oxygen or of carbon dioxide may be injected, the latter has the advantage of being more rapidly absorbed. Deformities of the kidney outline, such as might be produced by tumors or other gross lesions, are demonstrable." The shadow of the adrenal glands is also shown by Carelli's method which he has recently demonstrated in this country.

X-ray Diagnosis of Aortitis. Thomas Frazer, M. D., and John D. MacRae, M. D. Southern M. J., April, 1922, p. 261.

IT IS true that a careful history and physical examination is often all that is necessary to diagnose this lesion but signs and symptoms are not always commensurate with the changes actually existing; because of this fact the x-ray is a most useful aid in diagnosis and its use, at times, leads to the discovery of an aortitis or aneurism which otherwise would not be detected.

Knowledge of the pathology of the heart and great vessels and considerable technical skill is requisite for this diagnosis. Both the fluoroscope and plates should be employed; with the former should be noted, the shape of the heart, its position, action, and relation to other thoracic organs. Pulsation in tumors adjacent to the heart and great vessels can also be detected by the fluoroscope. For the radiograph the patient should sit erect, chest against the film, and the tube at the back so that the ray will pass through the spine of the seventh dorsal vertebra to the center of the film or plate six feet away.

One technique should be constantly adhered to and the examination should be conducted in routine manner. By the study of many normal hearts of different ages (though these will vary in type) an accurate knowledge of the anatomy of the normal heart will be acquired. The characteristic curves for the left border of the arch of the aorta will be the same for all types: the pulmonary artery, the left auricle and the left ventricle will be on the left of the midline of the chest; on the right is the curve representing the ascending aorta and the right auricle. This normal contour will be changed in aortitis and in aneurism. Sacular aneurisms of the ascending portion lie chiefly to the right of the midline; those of the transverse arch cast shadow

in the upper mediastinum, extending right or left. Aneurisms affecting the descending portion of the arch lie to the left of the midline. Illustrations accompany this description, also the following.

Aortitis with dilation frequently is not recognized until an x-ray examination is made. This type of disease is more often found in the ascending arch but may involve the transverse portion. Both dilation and elongation of the entire arch may be present, or there may be an abnormally broad aortal shadow. Widening and elongation of the aorta is often encountered in individuals past middle age and this fact must be borne in mind.

The Diagnosis of Chronic Appendicitis. Franklin B. Bogart, M. D., and W. H. Cheney, M. D. Jour. Tennessee State M. A., March, 1922, p. 410.

CHRONIC appendicitis may cause a great variety of symptoms, even when abdominal symptoms are slight. Diagnosis then becomes difficult and diagnostic studies should be full and complete before an opinion becomes a diagnosis. History, physical signs, gastric analysis, blood examination, radiographic examination, and differential diagnosis are all discussed.

The following is an abstract of the discussion of radiographic examination: A diagnosis of chronic appendicitis is rarely justifiable without first making plates and a fluoroscopic examination. This will eliminate certain factors from the diagnosis and will, if chronic appendicitis exists, give definite evidence. Gastric or duodenal ulcer, also some kidney conditions, may simulate chronic appendicitis. The same is true of gall-bladder disease and of pelvic disease.

The writers favor the buttermilk meal for visualizing the appendix. On the first day four ounces of cream of wheat and four ounces of barium sulphate are given (for accurate reading of motility of food), on the second day a suspension of four ounces of barium sulphate in buttermilk is given while the patient is being fluoroscoped. When the appendix is visualized the following points should be noted:

(1) *Size, length, and calibre.* Normally narrow and ribbon-shaped, average length three to five inches, may be ten inches long. (2) *Appearance.* Normally uniform in diameter, abnormally kinked, looped, constricted, or vacuolated. (3) *Direction.* Normally directed downward, abnormally directed in any direction. (4) *Fixity.* Normally freely movable, abnormally may be adherent anywhere along its course. (5) *Tenderness.* Elicited by

direct palpation of visualized organ. (6) *Emptying time.* Normally begins to fill at six-hour period after ingestion of barium meal, should begin to empty after twenty-four hours. Abnormally may remain filled many days.

If visualization cannot be accomplished by anterior-posterior plates it may be accomplished by oblique plates or by manipulation under the fluoroscope.

Other valuable information which may be gained from radiographic examination, and which is indicative of chronic appendicitis or of ileo-cecal adhesions are: stasis in the ileum, cecal stasis, adhesions between terminal loop of ileum and the cecum, incompetent ileo-cecal valve, tenderness and lack of free motility of the cecum, stone in the appendix.

Hypermotility, spasm at the center of stomach, pylorospasm, atonic conditions, enterospasm at the center of the transverse colon, and pressure over the region of the appendix causing visible spasm of the stomach wall (fluoroscopically) may be caused by chronic appendicitis, and their presence, or that of any one of them, should lead to careful examination of the lower right quadrant.

In the author's experience when the head of the barium column has not entered the cecum at the end of the six-hour period there is invariably chronic appendicitis present, or at least a chronic inflammatory involvement of the ileo-cecal region.

Pneumoperitoneum. Chas. L. Martin, M. D., Dallas, Texas. Texas State J. Med., April, 1922.

THIS article is a brief summary, written for the general profession, of the advantages in the pneumoperitoneal method in radiologic examination. The first observation on this method was made by Kelling in 1902, but little attention was paid to it until 1910 when Jacobaeus of Stockholm began using it in diagnosis. Dr. Orndoff, of Chicago, began its use about 1917, and Drs. Stewart and Stein of New York in 1919; the latter workers published the first report in American literature in November, 1919. Sante, Van Zwaluwenburg, Alvarez, Tyler and Rubin are quoted as having done valuable work with this method.

W. W. W.

The Business Side of X-ray Diagnosis and Treatment. E. M. Sunderlof, M. D. Bost. M. & S. J., March 30, 1922, p. 442.

D. R. Sunderlof, in a letter to the editor of the above journal, forcefully presents the business problems of

the radiologist and suggests a way to set about the solution of one phase of these.

By radiologists here is meant the accredited, ethical physician who has made a special study of radiology and who devotes himself exclusively to x-ray diagnosis and treatment.

The average patient and the average doctor can with difficulty be convinced that the average fee charged by the radiologist is not an excessive one. Every radiologist at some time encounters this unpleasant (because unjust) attitude.

The writer believes that a lack of knowledge of the expense and hazards of the practice of radiology accounts for this attitude of general physicians, specialists, and their patients and he states that a better understanding is not at all helped by the fact that many x-ray laboratories run by laymen, with no supervising physician, turn out vast numbers of radiographs (without diagnosis) for a small fee. These are then "interpreted" by dentists, physicians, and surgeons, who either are not cognizant of their limited ability to do this without special preparation, or else will not admit this limitation. The patient believes he has had the best of service and consequently regards the fees charged by the radiological specialist, for supposedly the same work, as exorbitant.

Furthermore, the hospitals are to blame in that they employ a technician instead of employing a competent and accredited radiologist (who of course cannot be secured for a technician's salary), and allow this technician to make the interpretations of plates and films. Many hospitals establish a fee list ranging from ten cents to ten dollars, which even with the comparatively low salaried worker employed does not approach the cost of equipment and running expenses. This sort of inferior service all over the country has the same influence that the commercial laboratory exerts.

Until the medical profession and the lay public are enlightened this sort of service will be rendered and accepted and the specialist in this line of work will continue to be misunderstood. Not only the lay public but many medical men are not sufficiently informed to know how much training enters in before a trustworthy diagnosis can be made, to say nothing of the enormous running expenses incurred by the specialist in radiology. He must have the best latest, largest, and most powerful equipment in variety sufficient to care for every case coming to him. The cost of installing this equipment would make even a plumber blush. Be-

sides there must be lead lined walls, separate rooms for various purposes, light and power. Chemicals and supplies too varied to mention enter into the running cost. Salaries are no small item, nor is wholesome charity excluded from the list. And besides these actual running expenses back of the type of radiologist under discussion are years of study and practical application of not only general medical knowledge but the knowledge of his specialty, and, like the ancient Athenians, the radiologist engages in a never-ending pursuit after "some new thing."

To quote Dr. Sunderlof's closing paragraph: "A sliding scale of fees is reasonable and just. The maximum fee that most radiologists ask is seldom—in fact, I think, has never been—excessive. If doctors in general understand the radiologist's work, the expense connected with it, the expenditure of time and energy involved, and the danger the radiologist faces, and explain these facts to their patients, a majority of the unpleasant discontent with the radiologist's fee would cease. The radiologist should never be a piece worker and commercialize his work by charging so much per plate. A true radiologist is a consultant and as such is entitled to a reasonably high fee for his expert knowledge and opinion."

The Prevention of Rickets in the Rat by Means of Radiation with the Mercury Vapor Quartz Lamp. G. F. Powers and E. A. Park, *Yale University*; P. G. Shipley, *Johns Hopkins University*; E. V. McCollum and Nina Simmonds, *Johns Hopkins University*. Bull. Johns Hopkins Hosp., April 1922, p. 125.

IN a previous article these authors showed that rats placed upon a rickets producing diet did not develop rickets if exposed to direct sunlight. In that communication attention also was called to the fact that other radiation than sunlight had been used in the treatment of human beings having rickets. The x-ray and the mercury vapor quartz lamp were two of these forms of light.

The authors' summary is quoted here:

"(1) The object of the experiments was to determine whether or not radiations from a mercury vapor quartz lamp would prevent the development of rickets in the rat.

"(2) A diet was employed which at room light regularly gives rise to a disease identical in its essential features with rickets as seen in the human being. The diet was high in calcium, low in phosphorus and was insufficiently sup-

plied with fat-soluble A. In other respects it was well constituted.

"(3) Nineteen rats were placed on the diet. Ten were exposed to radiations from a Hanovia 'Alpine' mercury vapor quartz lamp for varying periods of time (two to six hours) daily over a period of sixty-four days. Nine rats were kept as controls under conditions of ordinary room light.

"(4) One of the control animals was killed after thirty-eight days; another after fifty-eight days, and the remaining seven after sixty-four days. All of these animals showed gross and microscopic evidence of rickets.

"(5) The ten rats exposed to the radiations from the mercury vapor quartz lamp were killed after sixty-four days. These animals were free from rickets, both grossly and histologically.

"(6) The beneficial effects of the radiations from the mercury vapor quartz lamp were not limited to the skeleton, since the condition of the rayed animals underwent a general improvement." While the rayed animals were extremely active and always hungry, the controls were decidedly less active, had a "waddling gait," and did not eat as much as the others. One of the rayed animals gave birth to six young the thirty-seventh day of the experiment.

"(7) The effects of the radiations of the mercury vapor quartz lamp on the growth and calcification of the skeleton of the rat and on the animal as a whole seem to be similar to, if not identical with, those brought about by the direct sunlight and by cod-liver oil."

Studies on X-ray Effects. The Biological Action of Small Doses of Low Frequency X-rays. Waro Nakahara, Ph. D., and James B. Murphy, M. D., *Rockefeller Institute for Medical Research*. J. Exper. Med., April, 1922, p. 475.

PRESENT apparatus renders futile attempts so far made to compare the biological action of the soft, or low frequency, x-rays with the hard, or high frequency rays. But by varying the doses of both kinds of rays it seems definitely proved that with the softer rays it is possible to induce an apparent stimulation of the lymphoid cells preceded by only a very short and transitory period of depression. With the hard rays the stimulation phase is less pronounced.

The study here recounted deals with the effect of still softer x-rays than those used in previous experiments and for the generation of these rays the special tube described below was used.

The following is the authors' summary of this study:

"A study has been made of the biological effect of a small dose of soft x-rays given off by a special water-cooled tube with a window of thin glass, operated at one-half inch spark gap and eleven ma. Mice exposed for one minute show, two days later, in the blood an increase in the number of lymphocytes and in the lymphoid organs an increased number of mitotic figures. There occurs also a marked dilation of the vessels of the suprarenals, particularly between the cortex and the medulla. The latter condition did not appear until after twenty-four hours, and was still present fourteen days after treatment. No change was detected in other organs.

"Mice treated in this way showed a high degree of resistance to cancer transplants. The amount of resistance varied with the time of the inoculation after the treatment. The resistance was not increased before three days after, and was at its highest point ten days after the treatment."

The authors state further that, so far as is at present known, the only physical or chemical change induced by the x-ray depends upon its power to ionize; if this be true it is still a problem why some types of animal cells are so profoundly affected and others not at all affected by the x-ray.

That a biological change may be induced by a small dose of very soft x-rays is here shown, but no reaction of this nature with harder rays could be obtained. Until it has been determined that the dosage is the same, the question whether this is a real difference in biological action must remain unanswered.

The writers do not believe that the changes here wrought in the lymphoid organs are the result of direct action of the rays. They incline to this opinion partly because of the small dosage and partly because the deeper nodes reacted as much as more superficial ones. The significance of the changes in the suprarenals is not yet understood. The testicle and ovary, supposed to be extremely sensitive, are not at all affected by this treatment.

The virulence of the strain of tumor used to test the resistance of the mice was such that so-called natural resistance was almost completely obviated.

Studies on X-ray Effects—The Fate of Cancer Grafts Implanted in Subcutaneous Tissue Previously Exposed to X-rays. J. Henk Liu, M. D., Ernest Sturm, M. D., and Jas. B. Murphy, M. D., *Rockefeller Institute for Medical Research*. J.

Exper. Med., April, 1922, p. 487. It has been shown by Murphy, Hussey, Nakahara and Sturm that an erythema dose of x-rays produces in the skin layers of mice a reaction characterized by lymphoid infiltration coincident with a local increase in resistance to transplanted cancer. These x-ray areas are refractory to subsequent intracutaneous inoculation of cancer, but subcutaneous inoculation beneath the x-rayed areas results in the same number of growths as in normal areas. This furnishes a possible explanation of the different reactions to x-rays of skin cancer in man and the same cancer in the superficial lymph nodes of man.

To determine whether direct exposure of the deeper tissues renders them refractory to implanted cancer, a series of experiments were carried out upon normal white mice.

In one series tumor inoculation was made after exposure of the subcutaneous tissue to x-rays, using a three inch spark gap, ten ma., six inch distance, two and one-half minutes, over an area of about one and one-half cm. extending laterally across the abdomen; all the rest of the animal's body was protected by sheet lead. The average resistance of these animals was sixty-six and one-tenth per cent. The average resistance of the controls was seventeen and four-tenths per cent.

In the next series the same exposure was made over the skin intact. Afterwards incision and inoculation were made. The tumor grew in all of these.

In another series, after a local exposure of subcutaneous tissue to the rays inoculation was made in a protected area and was successful in nearly the same percentage as in the normal control animals.

The authors' summary is as follows:

"An erythema dose of x-rays given direct to the exposed subcutaneous tissue and muscle greatly diminishes the susceptibility of the exposed area to transplanted cancer. The same dose given over the intact skin does not affect the resisting power of the underlying subcutaneous tissue.

"Histological examination shows that a few days after the exposure of the subcutaneous tissue there is a lymphoid infiltration of this tissue, which infiltration sometimes includes the muscle layers as well."

Action of Radium and the X-rays on the Blood Forming Organs. Isaac Levin, M. D. *Am. J. Roentgenol.*, February, 1922, p. 112.

KNOWLEDGE of the individual function and correlation of erythrocytes, polymorphonuclear neutrophile leukocytes, and the lymphocytes,

is yet incomplete, and this makes difficult the correct estimation of the mechanism of the action of any agent upon the blood and the blood-forming organs.

As a general rule the action of radium and x-ray on the normal blood diminishes the number of lymphocytes and relatively increases the number of polymorphonuclear leukocytes.

Connective tissue formation can take place only when the lymphocytes and lymphoid tissue of the organism remain intact, therefore, the influence of x-ray and radium upon these is of the greatest significance.

Previous experimentation on turtles' blood by this method showed that the numerical relationship between the leukocytes and lymphocytes changes greatly soon after radiation, then gradually returns to normal, and at the end of twelve days the blood contains the same relative number of cells as before radiation.

The experimentation here recounted consisted of subjecting to radium and x-rays normal frogs, and also frogs in which a change in the white blood cells had been brought about by a preliminary injection of yeast. A similar study was carried out upon rabbits.

A total and differential blood count of each animal was taken before treatment. The whole body of the frog was exposed for fully five minutes, using a Coolidge tube, nine inch spark gap, seven ma., eight inch focal distance, no filtration. Blood counts taken at intervals for four days gave a total leukocyte count only slightly different from the normal count. The differential count showed a marked change in numerical relationship between the polymorphonuclear leukocytes and the lymphocytes. The number of eosinophiles and transitionals remained practically the same. The blood became normal in about four days.

From 1.0 to 9.6 of radium emanation in glass tubes was introduced into the dorsal lymph-sac of a frog and results were analogous to those just recounted—the only difference being in the time at which change was most marked, twenty-four hours with x-ray and seventy-two with radium.

The injection of yeast into normal frogs produced a blood change similar to that produced by x-ray and radium, and when these agents were then applied no further change was induced.

Experimentation upon the rabbits yielded identical results when x-ray was used. Radium experimentation was carried out by inserting from two to four radium emanation capillaries into the spleen, and in another series of animals, into the long bone. Examina-

tion showed no change in blood structure. The reason for this is that the effect is distributed, in the rabbit, in a larger quantity of blood than in the frog. On the other hand the square surface of the rabbit's body is greater than that of the frog, and so under the same exposure to x-rays the rabbit's body received a greater amount of radiation. Biologically these dosages of x-rays and radium are analogous, for they produce an identical effect upon the frog's blood.

Radium, as compared with x-rays, will produce the same and even a more marked local effect with far less general disturbance of the blood. The larger the square surface of entry for x-rays the more severe is the general effect upon the blood. Biological conditions as well as purely physical conditions are a factor in estimation of correct quantity and quality of radiation.

Dr. Schmitz in his discussion stated that unless there was an active decrease in the total number of corpuscles there was no real effect manifested.

Self-Retaining Radium Holder for Tonsil Work. Cosby Swanson, M. D., and William H. Hailey, M. D., Atlanta, Ga. Jour. A. M. A., April 15, 1922, p. 1125.

BY removing the spring clamps holding the gauze pad, also the knob, from the inner blade of a Corwin tonsil hemostat, enlarging the hole in the inner blade to fit the peg on a thirty mg. oval radium plaque, and placing a rubber cot over the radium and inner blade the writers made a practical device for holding radium against the tonsil.

Metatarsophalangeal Fractures, With Report of Twenty-seven Cases. By Alfred G. Bolduc, M. D., J. Industrial Hygiene, April, 1922.

AFTER several years' study of foot injuries, the x-ray is the only certain method of ascertaining the existence or non-existence of metatarsophalangeal fractures, and all foot injuries should be radiographed. The fractures found in this series were, in order of frequency, chip fractures, proximal phalanx fractures, metatarsal fractures. In comminuted fractures of the distal phalanges, surgical treatment is indicated, conservative treatment being of little avail. End results are good if properly handled. W. W. W.

The Early Diagnosis and Treatment of Hyperthyroidism. Emil Goetsch, M. D. N. Y. Med. J., March 15, 1922.

THIS fairly comprehensive article on hyperthyroidism, outlines the early symptoms, the pathological changes,

clinical tests, including, of course, the Goetsch test.

The treatment is discussed under medical, x-ray and surgical headings. The x-ray treatment is commended as a pre-operative method in a limited number of cases and "damned with faint praise" when regarded as a method of treatment per se. The article rightly emphasizes the difficulties and dangers both of x-ray and surgical methods of treatment, and insists that, in either instance, these cases can only be handled by those with particular training and experience.

W. W. W.

Hyperthyroidism. By Israel Bram, M. D. N. Y. M. J., March 15, 1922.

THIS article, which immediately follows the one by Goetsch, illustrates the wide diversity of opinion in regard to thyroid conditions, and justifies the radiologist in holding to his own opinions and treating thyroid conditions as he himself thinks best. Bram concludes his argument for purely medical handling of thyroids by the statement: "In brief, the properly equipped internist, after eliminating those who are moribund the insane, and the non-operative, should obtain approximately one hundred per cent recoveries."

This author does discuss x-ray as an adjuvant to other non-surgical measures in cases where the thyroid hyperplasia is unusually great.

This article and the preceding one, by Goetsch, are well worth reading, because they will stimulate the radiologist to continue the excellent work he is doing in thyroid diseases.

A Plea for Early Diagnosis and Treatment of Hyperthyroidism. C. W. Dowden, M. D., and C. D. Enfield, M. D. Kentucky M. J., March 1922, p. 196.

TREATMENT of hyperthyroidism, to be entirely satisfactory, must be instituted in the earlier stages of the disease, before organic damage has been wrought.

The bearing of the basal metabolic rate, the use of adrenalin (for observation of pulse, blood pressure and tremor), and the sugar tolerance test are discussed. The adrenalin test the author does not regard as useful. Vague and indefinite symptoms are also discussed.

It is asserted by the writer that no medical treatment of hyperthyroidism has as yet stood the test of time. Surgery and roentgenotherapy are the only means of therapy that these writers regard as useful in this disease.

Crile's summary of the relative advantages and disadvantages of surgical and x-ray treatment are discussed and

Crile's statement that operation is not more painful than x-ray is criticised, because x-ray has no attendant discomfort. A contrast is drawn between the period of incapacitation following surgery and the relatively very little time required for roentgenotherapy of this lesion. While Crile shows a one per cent death rate in his statistics, x-ray statistics show absolute lack of mortality applied to this particular treatment. In answer to the statement of Crile that surgery is the more curative treatment the authors of this paper reply that since many patients will not submit to surgical treatment, but will submit to x-ray in the early and curable stage of the disease, that x-ray therefore could and does often prevent a fatal outcome in these particular cases. Also the authors favor roentgenotherapy because of the fact that it attempts to restore the normal thyroxin balance without a mass attack. If this attempt fails surgery is still an open recourse.

The technique employed by these authors is as follows: The basal metabolism test, the Goetsch test and the sugar tolerance test are all made before x-ray is given. Three areas are treated, one on the right over the thyroid going to the middle line, similarly one on the left, and a third one over the thymus region. Eighty kv. (about eight and one-half inch spark gap), five ma., twelve inches anode-skin distance, four mm. aluminum and one cm. of sole leather, ten to fifteen minutes exposure at intervals of a week or ten days. Six such treatments are given unless the pulse drops rapidly after the first three or four treatments.

After a period of two to three weeks the metabolic rate is again taken. If this is still high only a month's rest is given and a second series of similar treatments is then employed. Otherwise a three months period is allowed to elapse and the basal metabolic rate is then again determined.

Complete cure, as far as symptoms and laboratory tests can determine this, has been accomplished in some cases and decided relief has resulted in others. Case reports are appended.

The Actinic Ray. C. B. Witter, M. D. Albany Medical Annals, March, 1922, p. 125.

THE blue and violet rays are the shortest visible rays of sunlight. Beyond these are the shorter invisible ultra violet rays, and beyond these the roentgen rays and the radium gamma rays.

At high altitudes the ultra violet rays are present in large quantities in sunlight, but at lower altitudes the dust particles and moisture in the air filter out and absorb these rays.

Bovie of Harvard, and Beige of the University of Illinois have proved that ultra violet light will kill bacteria within five minutes.

The ultra violet ray has four important effects: photochemical, ionic, fluorescent, and biologic. It has a biological effect as the result of local activity and general systemic action. The local activity ranges from slight capillary engorgement to exudative inflammation. As for systemic effect, the time and intensity depend upon the reaction sought, as the actinic ray produces changes in the quality of the blood, a leukopenia and subsequent leukocytosis.

The three types of reaction of therapeutic value are: stimulative erythema, regenerative erythema, and destructive erythema. Dosages producing these are used respectively as is sought a bactericidal and stimulative effect, or this plus capillary reaction, or these two effects plus destruction of cellular layers.

Actinotherapy in General Practice. F. J. Kern, M. D. Ohio State M. J., April, 1922, p. 286.

THE writer states that in the role of a doubting Thomas he began the use of actinic rays in his general practice and that he has treated several thousand cases by this means with such results that he now considers this form of therapy to be one of the most useful and valuable of aids.

The following cases are reported from his practice: sciatic neuritis, pruritis, tonsillitis and mumps, mumps, scabies, epididymitis (gonorrheal, also tuberculous), acute nephritis, pulmonary tuberculosis, "rheumatism," chorea, cellulitis, carbuncle, leukorrhea, chronic eczema. Some of these cases were cured and other benefited by the rays. The writer's conclusions are:

1. Actinotherapy is an effective mode of treating many chronic and obscure cases which the general practitioner has, heretofore, had to refer to the specialist.

2. Ultra violet rays are antiseptic, bactericidal, markedly analgesic, nerve sedative, and greatly assist in promoting the general metabolism.

3. Actinotherapy is one of the best treatments in early stages of tuberculosis wherever found, and far superior to natural sunlight on account of its applicability at all places and in all climates. It is of especial merit to patients who are unable to go to sanatoria.

4. In simple neuralgia and neuritis the actinic rays are almost specific, giving in many instances almost instant relief.

5. Severe reactions and prolonged treatment are often necessary to obtain satisfactory results in some chronic cases.

6. Only those who use this modality persistently and conscientiously know its real value.

The Ultra Violet Ray in the Treatment of Roentgen Ray Telangiectasis. H. H. Hazen, M. D. Am. J. Roentgenol., Feb., 1922, p. 101
DR. Hazen states that he does not advocate the use of the Kromayer lamp for all skin affections but that he has been very successful in obliterating the dilated blood-vessels of telangiectasis by this means.

Fifteen to twenty minutes to each area, using a quartz compression lens with an active lamp has accomplished this effect in from one to two treatments. Eight lesions, two of them large ones, have been successfully treated. A slightly whitened scar is the resultant appearance of the area treated.

The Cancer Problem in the Southern States. Frederick L. Hoffman, Statistician, The Prudential Insurance Company of America, J. S. Carolina M. A., March, 1922, p. 51.

THE cancer rate in the United States is lower in the north and west than it is in the south, though the data upon which this information is founded are not entirely satisfactory to the statistician, as data for southern rural territory are unavailable as yet.

In general, the cancer rate among the colored population of the south is lower than among the whites, though the reverse is true of uterine tumors in particular.

Cancer is practically nil among the native races of the tropics. The writer believes that this is primarily a matter of nutrition, style of clothing, and general environment. The protein content of their food is less and their clothing always loose. Among the negroes of our south, before the Civil War, cancer was practically an unknown occurrence, but today it is common among them. The writer attributes this change to (1) adoption of white people's mode of clothing, (2) hypernutrition, (3) lower birth rate (abortions), (4) artificial feeding of infants (interference with normal lactation), (5) modern housing with its attendant exposure to sulphurous contents of coal smoke.

Theories of infection, contagion, and heredity are not supported by the general history of cancer, but it is noted that cancer oftener occurs among the well to do and healthy than among the poor and diseased.

The writer believes that negative evidence rightly applied may lead to more important discoveries in regard to prevention than biological investigation has yet produced.

The tumor problem, benign and malignant, as it affects the southern negro women, is an urgent one, as uterine fibroids are of extraordinary frequency among them. In justice to the white people of the south, he states that wherever cancer therapy is available for them it is also available for the colored population, however poor the latter may be.

The Radiation Treatment of Hypertrophied Tonsils. Herman A. Osgood, M. D. Am. J. Electrother. and Radiol. March, 1922, p. 79.

THE x-ray treatment of hypertrophied tonsils aims at the reduction and atrophy of the lymphoid elements in the lymphoid tissue, which is very susceptible to radiation. Radiation does not produce a bactericidal effect, but mechanical eversion of the crypts is brought about by shrinkage of the lymphoid elements. The resultant proper drainage eliminates bacterial infection in properly selected cases.

Cases must be properly selected—atrophy infected tonsils, or those with buried abscesses are unsuitable for treatment. Results, with proper technique, are reasonably sure and the discomfort slight.

Proper protective measures and proper dosage must be observed. Inexperienced operators are apt to try to hasten matters by increasing the dosage. The technique in average cases is: For adults—spark gap, seven inches; ma. five; filters, three mm. aluminum; distance, ten inches; time, five minutes. For children, subtract approximately one-fourth minute for every year under sixteen. Factors used with one machine are not necessarily applicable to another, and strict adherence to the limits of safety must be observed. The above dose is usually given at intervals of two weeks, and from six to eight times. If large doses are given the intervals between must be from three to four weeks. Usually two large doses are required for adults and smaller doses at more frequent intervals for children.

Radium may be used intra-orally, combined with extra-oral x-ray treatment. A thirty to fifty milligram plaque brought into direct contact with the large tonsil is used, previously swabbing the throat with novocain. Radiation therapy of the tonsils is not urged as a replacement of tonsillectomy, but is especially indicated in case of cardiac, renal, or pulmonary complications. It has the disadvantages of re-

quiring longer time and suitable selection and the advantages of no danger from anesthetic, hemorrhage, or pulmonary complication.

Radium Therapy. By Wm. D. Haggard, M. D., and Carl R. Crutchfield, M. D., J. Tenn. M. A., March, 1922.

THESE authors make a preliminary report on two hundred and fifty cases treated with radium, since 1917. Of these one hundred and forty-five were carcinoma, twenty-four sarcoma, seventy-one benign. Of the one hundred and sixty-nine malignancies, one hundred and eleven are living, forty-two dead; of the twenty-four sarcoma, fourteen are living.

Sarcoma has given the best immediate results, although showing the usually reported tendency to develop metastases.

Skin cancers showed from eighty-five to ninety-five per cent of permanent cures. Cancer of the lip springing from the skin surface should be treated by radium; springing from the mucous membrane it should be treated by combining radium with surgery.

In cancer of the cervix, radium gave apparent local and clinical cures in from twenty-five to thirty per cent of cases, and as a palliative, its effect justified its routine application.

Cancer of the rectum was unsatisfactory when treated with radium alone, and surgical combinations are advised.

All the non-malignant conditions gave satisfactory permanent results; these included port wine stains, birth marks, forty per cent of uterine fibroids, idiopathic uterine hemorrhage at the menopause, and so-called precancerous lesions.

W. W. W.

A New X-ray Technique in the Treatment of Malignancies. Wm. H. Dieffenbach, M. D., J. of Inst. of Homeopathy, April, 1922.

THIS author describes his method of utilizing secondary rays, either scattered rays, beta rays, or characteristic rays. He does this by means of cataphoresis plus the parent x-ray; he impregnates the lesions with argyrol by cataphoresis and then administers the x-ray dosage. The method of inserting metallic plated instruments into lesions, or into body cavities, and then administering the x-ray dosage, is described.

W. W. W.

Radium Therapy of Cancer of the Mouth and Throat, by Everett Field, M. D., N. Y. State J. Med., March, 1922.

THE author discusses the treatment of these very difficult cases, and insists that coagulation necrosis is fre-

quently a necessary adjunct to radium in the mouth and throat. In carcinoma of the jaws, buccal cavity and larynx, radium has a limited advantage and permanent results are seldom secured.

For preoperative effect on neck glands to prevent metastases, about three thousand milligram hours are required, filtered through one and one-half mm. of brass at two cm. distance.

In lip epithelioma, from fifty to two hundred milligram hours through one-half to one mm. of metal and two to four mm. of rubber; where nodular masses are present, needles of radium element, thirty milligram hours per cc. of tissue is effective. In tumors of epiglottis or larynx, twenty-five to thirty-five milligram hours per cc. of tissue by buried needles is advised, with cross fire of about two thousand milligram hours from the outside.

This author does not believe that buried emanation is superior to needles.

W. W. W.

Radium and Deep Therapy in the Treatment of Malignancy. Russell H. Boggs, M. D., Pa. J. Roentgenol, April, 1922, p. 4.

INSUFFICIENT equipment and lack of technique, plus extravagant claims characterize the early days of x-ray treatment and good results in the treatment of basal cell epithelioma was the first, and for some time the only therapeutic triumph in the x-ray field.

Filtration and cross firing marked the beginning of a new chapter in x-ray history and likewise the new transformers now on the market will write still another one. These will bring changes in technique, and until these are definitely fixed, caution must be used.

In the case of radium, more uniform results are now secured. Small or large quantities are prescribed, according to the size and depth of the lesion.

In general, the science of radiotherapy has so advanced that in the treatment of some types of malignancy it is superior to and has replaced surgery.

In radiotherapy a lethal dose must be given to all deep carcinomatous tissues, this usually requires from seven to ten skin erythema doses, four inches below the surface of the skin.

For epithelioma and for malignancies of the mouth and throat radium is more efficient than surgery, because cancerous dissemination in the lymphatic spaces and glands, even at a considerable distance from the primary focus, is usually present, even in the early stages. For the treatment of these malignancies a thorough knowledge of the anatomy of the lymphatic system of these regions is imperative.

Good results in carcinoma of the tongue are difficult to obtain, because of early metastases. The grooves between the tongue and the tonsil must always receive radiation. Extensive surface radiation, together with intensive radiation of the lymphatics, combined with buried radium in tongue and tonsil should give the best results, and in some cases should be followed by electro-coagulation. If operation is performed radiation should precede it by five or six weeks. Radium is the treatment of choice in most cases, however, as more cures result from its use (the disease being removed without opening the lymphatics), it causes no deformity and patients will earlier submit their case to it than to surgery.

In sarcoma of the tonsil and throat, a clinical, but not a lasting cure, can be obtained. A better understanding of this type of lesion has led to deep radiation of the glands of both sides of the neck as well as the mediastinum, and better results are hoped for in the future.

Cancer of the breast, because of its lymphatic supply, is most difficult to treat and also because of this fact radium and x-ray are preferable to surgery alone. Radium before and after operation is the method of choice in early cases, and in most advanced cases radiation without operation is best. Every chain of lymphatics should receive a lethal dose. The author uses surface applications of radium and x-ray, using high penetrating radiation, and as much cross fire as possible. Two to three weeks later radium needles are inserted throughout the breast, into the axillary glands and the glandular tissue extending from the breast to the axilla, and also beneath the clavicle. In early cases operation should follow in from four to eight weeks following this; in some of the late cases removal of the breast (without opening the axilla) is advisable.

Gynecologists were the first surgeons to advise primary treatment of carcinoma of the cervix and uterus by radium; but because gynecologists and other surgeons have made use of inefficient quantities of radiation, combined with poor technique, and have in their treatment omitted the deep roentgenotherapy of adjacent glands, their efforts have not been successful and have led to their dissatisfaction with the method. The treatment of cancer by radiation is a specialty requiring comprehensive study, and he who lacks this cannot hope for success. On the other hand, the radiologist must be capable of diagnosing and differentiating the different steps of the disease or he likewise will do more harm than good.

Best results follow local treatment with radium, as much as the tissues will stand, combined with as much extensive radiation as the skin will tolerate. Reports from the German clinics have led some astray in this matter. The author considers it as unwise to attempt to destroy cancer cells in the pelvis, through the skin, when these lesions can be treated locally by radium, as it would be to try to kill cancer cells in adjacent glands by local applications of radium.

Early cases of carcinoma of the cervix and uterus can be clinically cured by radium, but whether end results will prove equal or superior to surgical removal cannot yet be definitely decided. For border-line and advanced cases radium and deep therapy are best. In inoperable cases radium is a specific palliative, clinically curing about one-third of these cases and improving all others.

The Treatment of Malignant Tumors of the Pharynx and Larynx by Diathermy. Frank J. Novak, Jr., M. D., Illinois M. J., April, 1922, p. 252.

THE special application of diathermy to cancer of the larynx is recent. The great problem in diathermy has been the perfection of a high frequency apparatus capable of producing a current of low voltage, high amperage and extremely high frequency. The new Victor apparatus produces deep penetration of tissue without carbonization. The heat produced is the result of the resistance of tissues to the high frequency of the D'Arsonval current.

The principal of diathermy is based upon the facts that local application of sufficient heat to a neoplasm destroys the tumor mass, and that lower degrees of heat applied to the periphery of the mass and beyond inhibits the growth of the migrating neoplastic cells. The occlusion of lymph spaces and channels and the function of scar tissue aid this last process.

In the early stages of carcinoma of the larynx the author believes that diathermy is the treatment of choice. The consensus of opinion of those using this method is that its combination with radiation gives mutual advantages to each method, which either one used alone does not possess.

The thermo-cautery has failed because deep penetration of heat is essential to successful treatment. Surgical removal is apt to be incomplete, often stimulates the growth and disseminates metastases by the opening of lymphatics and blood vessels.

Chloroform, administered always by a skillful anesthetist, has been found to be the best anesthetic to use with

this form of therapy. Local anesthesia, nitro oxide, and ether are all unsuitable and the last of these especially dangerous with diathermy.

Laryngotomy as a method of approaching the larynx is not used because the knife may penetrate the tumor mass and metastases follow. Suspension laryngoscopy is used and recommended to others. A preliminary tracheotomy is necessary in all these cases.

From one thousand to fifteen hundred ma. of current are used and the average length of exposure is twenty seconds, but the time varies with the rate and extension of coagulation. Fractional coagulation is preferable.

Lessening of pain is a striking feature of the immediate after effects. The necrotic mass separates within ten days. It is too early in the history of cases so far treated to form definite conclusions, but favorable end results are expected.

Treatment of Glandular Metastases of Carcinoma. Russell H. Boggs, M. D., Am. J. Roentgenol, February, 1922, p. 117.

SITUATION, extent and depth of disease, amount of cross-firing necessary, and the ratio between the erythema and lethal dose in malignancy are the most important factors to be considered in the treatment of metastatic glands.

A point heretofore too little considered, is that palpable enlargement of the glands of one lymphatic chain is usually accompanied by microscopic involvement of the next chain.

Metastasis and recurrence, it should also be noted, are not synonymous terms; the former is the spread of malignancy and the latter refers to a return of malignancy in the region of the primary growth.

Escaping from the primary growth into the lymphatic vessels cancer cells may lodge there and form a secondary growth, or may be carried to the lymphatic glands, where they may possibly be destroyed or they may produce a secondary growth there if not destroyed.

All of the lymphatic system adjacent to a primary growth should be rayed—this is patent from the intimate relation known to exist between carcinoma and the lymphatics. The radiologist must know the paths of dissemination, therefore.

Ewing's summation of Handley's conclusions in regard to the likely path of metastatic travel is given. This is applicable to any organ. A similar description of the drainage of mouth and throat areas is also given.

The method of treating metastatic glands varies and good results are se-

cured by these various methods. Methods in use at the Freiburg and Erlangen clinics are discussed. The Germans state that even less than an erythema dose will destroy cancerous cells, and the author takes issue upon this point.

Radiation is the only therapeutic measure which offers anything at all when more than one chain of lymphatics is involved, even though microscopically. The most effective method is one by which the largest amount of radiation will reach all cancerous cells with the least injury to overlying structures.

High Voltage X-ray Work. W. D. Coolidge and W. K. Kearsley, M. D., Jr. Am. J. Roentgenol, February, 1922, p. 77.

THE original paper covers some twenty-four pages of description accompanied by charts, diagrams and tabulations. The following summary by the authors is slightly abbreviated from the original.

1. A design of x-ray tube is shown which has served for experimental work up to 300,000 volts maximum.

2. This type of tube can apparently best be operated from either a high voltage transformer with mechanical rectifier and resistance control, or from a suitable source of high voltage direct current. (The x-ray output and tube behavior with other high tension systems are also discussed.)

3. An experimental interrupterless machine is described which has operated satisfactorily, even in humid weather, at voltages up to 300,000.

4. A constant-potential continuous current machine, for voltages up to 200,000 is described.

5. As measured by the penetration through ten cm. of water, two hundred kv. direct current excitation is equivalent to two hundred and thirty-five kv. (max.) of alternating current excitation. At these voltages the x-ray intensities are the same for equal milliamperage.

6. For the medical application, it looks much safer to judge of x-ray intensity and quality, from sphere gap and milliamperemeter measurements of the electrical energy put into the tube rather than from direct measurements made with an ionization chamber.

7. Even when such outwardly different high voltage sources as the transformer with mechanical rectifier on the one hand and the induction coil on the other are used the resulting radiations differ in quantity and quality by scarcely more than the experimental error, when the energy input is controlled by a standard sphere gap and a milliamperemeter.

8. The voltage at the terminals of the x-ray tube should be controlled by a voltmeter connected across the low tension side of the high voltage generator, and the low tension voltage required to produce the desired tube voltage should be frequently determined by means of a standard sphere gap connected in parallel with the tube. This calibration must be made at the exact milliamperage which is to be subsequently employed.

9. For accurate duplication of results, it is desirable that the design of the high tension source shall be such that, for a given high tension voltage, the required primary voltage will not change rapidly with the milliamperage passing through the tube.

10. For the measurement of the tube current in therapy, two milliamperemeters should always be used in series with the tube, and they should be occasionally compared with a standard meter.

11. Where an interrupterless machine with resistance control is employed and the tube filament is heated from the same source of current supply, the milliamperage should be held very constant by a suitable stabilizer, as otherwise line voltage fluctuations will cause marked fluctuations in the high tension voltage, owing to the presence of the resistance in the low tension circuit.

12. At 200,000 volts (max.), with as much as 0.2 mm. of copper filter, different "high voltage" tubes differ but little in output, the average deviation from the mean in a series of twenty tubes being only one and one-fourth per cent.

13. At 127,000 volts (max.), with as much as three mm. of aluminum filter, different "Universal" type tubes differ but little in output, the average deviation from the mean in a series of seventeen tubes being about three per cent.

14. Where no filter is used, tubes differ markedly in output, owing to differences in bulb thickness. This would be of no importance in connection with plate density in diagnostic work, in which the patient's body is interposed between the tube and plate or tube and screen; it might, however, be quite important in skin therapy with unfiltered radiation.

15. For the therapeutic application, the effect of the tungsten deposit on the bulb can apparently be neglected.

16. Bad pitting of the target appreciably reduces the efficiency of the tube in the direction of the central beam. For this reason, therapy tubes should not be used for radiographic work, in which pitting might occur.

17. Curves are given showing the distribution of x-ray intensity in different directions around the focal spot, at voltages of 127,000 and 200,000.

18. The intensity maximum does not lie in the "central beam," but from ten to twenty degrees away from this towards the heel of the target. (This is probably due in the main to the fact that the cathode ray stream does not hold to the axis of the tube, but is electrostatically deflected towards the toe of the target.)

19. In the equatorial plane (about the girdle of the tube) the intensity is essentially constant through an angle of about one hundred degrees.

20. The distribution curves for a badly pitted target are also given.

21. Absorption curves are given for copper, extending up to two hundred and ninety-eight kv. (max.) They show the attractiveness of high voltage excitation if a considerable intensity of very penetrating radiation is required.

The lowest value of the average linear absorption coefficient indicated is 2.31. This corresponds to a wavelength of 0.072 Å.

Problems in Massive Dose X-ray

Therapy—Newer Methods of Application and Measurement. Edwin C. Ernst, M. D., J. Missouri S. M. A., April, 1922, p. 144.

DR. ERNST believes that eventually cancer will be treated by a blood serum. For the present combined methods must be used—surgery, the cautery, coagulation, desiccation, radium and x-ray. No one man can fully master all of these and therefore selective co-operation among a group of specialists is absolutely essential.

Of all these methods radiation therapy has perhaps made the greatest advancement. The author discusses the physics of this subject somewhat in detail for the sake of the general practitioner, and a portion of his summary is here quoted:

"Each individual deep therapy transformer should be standardized and periodically the potential should be checked by means of sphere gap measurements. Filtration material should be tested carefully by photographic methods to exclude variations in quality or quantity. The high tension meters should likewise be frequently calibrated.

"In addition to the above standardization of technique and consideration of mechanical details, extreme caution should at all times be exercised in the administration of these intensive radiation by further careful attention to the individual characteristics of both the patient and the local lesion."

The writer states that as nearly as is possible with available apparatus he has sought to duplitize the techniques applied by Kroenig, Friedrich, Desauer, and Schoenburg. Minimum exposure was three hundred milliamperes minutes over a single area, the maximum dose was seven hundred milliamperes minutes. Three ports of entry were used and the following factors were kept constant: Filtration, one-half mm. copper and the equivalent of eleven mm. of aluminum and glass. Focal distance limited to thirty-five centimeters. Voltage readings (sphere gap measurements) 140,000 volts. Current passing through Coolidge tube, five ma.

Time was the only factor not remaining constant. The entire dose he extends over a period of from three to five successive days.

Minimum exposure produces very faint tanning; maximum exposure is very severe and applicable only to inoperable breast pathology. The danger from toxicity resultant upon continuous treatment over six hours must be avoided. Selection and distribution of these massive doses must be according to individual need. Previous treatments must be taken into account.

A graduated standard technique with a known and tested apparatus, frequently corrected meter readings, non-variable and measured potential, and carefully selected and tested metal filters are absolutely requisite to this intensive therapy.

These massive doses have been employed by the author for a period of only five months, and therefore definite final conclusions cannot as yet be drawn but such results as have been obtained are promising. Palliation in malignancy of the stomach is especially discussed. Uterine malignancy has responded more favorably than any other type.

Roentgenotherapy in Tuberculosis. Fritz Hilpert, M. D., *Erlangen Clinic*. Muenchen. med. Wchnschn., March 10, 1922, p. 348.

THE internist may no longer ignore the fact that roentgenotherapy has attained a place in the treatment of tuberculous lesions.

Much has been written upon this subject and many varying techniques are advocated by different roentgenologists. These are all discussed in the original paper. For a long time only small doses were employed until Wintz appeared upon the scene with his technique for this lesion; the dosage used by him is equivalent to fifty to sixty per cent of the skin-unit-dose (HED) advocated by him.

It must be clearly understood that this dosage does not apply to the treat-

ment of pulmonary tuberculosis. In contrast to this dosage the one advocated by Bachmeister is very small, and Stephen has advanced the theory that there is one common dosage (ten per cent HED) applicable to all tuberculous lesions.

The rather widespread idea that there is a common dosage has undoubtedly brought with it some little confusion and whether there is a common dosage for tuberculosis is a question that must be settled. The author, for his part, has arrived at these conclusions:

There is no common dosage for tuberculosis. The dosage established by Wintz, fifty to sixty per cent of the HED, and employed in tuberculosis of the peritoneum and tuberculosis of the lymphatic glands, the author of this paper considers to be a little too high. He advocates a dosage of forty to fifty per cent HED instead. Stephan's dosage of ten per cent HED in the treatment of pulmonary tuberculosis he believes has only questionable value.

The author uses, for the above mentioned lesion, six per cent HED at the beginning of treatment, gradually increasing it up to fifteen to twenty per cent. Around twenty-five per cent is the best dosage in combating tuberculosis of the larynx and much larger doses must be employed for lupus and for tuberculosis of the skin—at least eight per cent HED. These dosages are to be delivered to the focus of the lesion; if the lesion is a superficial one, one port of entry is usually employed, in the deeper lesions two or more are necessary.

The author states that his experience with this form of therapy leads him to the conviction that the roentgen rays are a useful adjuvant in treating tuberculosis of the peritoneum, the lymphatic glands, also pulmonary tuberculosis, tuberculosis of the larynx and of the skin.

Post-Operative Mastoid Treatment with X-ray. Charles Goosmann, M. D., J. Radiol., June, 1922.

THE writer, knowing that patients with acute mastoiditis often experience relief after the slight exposure incident to taking plates, decided to use postoperative roentgen treatment with mastoid cases not properly healing.

The postoperative interval among cases so treated by him has varied from twenty-five days to five years. The results are such that he now advocates the use of roentgenotherapy in such cases.

Roentgen Ray Anthropometry of the Skull. A. J. Pacini, M. D., J. Radiol., June, 1922.

THIS thesis, awarded first place in the Leonard Research Prize Contest, is here published in part as the first of a series to appear upon alternating months in the Journal.

There being no consciously propounded and scientifically defended system of roentgen ray anthropometry anywhere extant, this subject was chosen by Dr. Pacini for an original thesis. It is thought that the research here recounted may serve, not only the medical profession, but the arts and other sciences as well. "It does not appear that roentgenology has heretofore been propounded as the basis of an anthropometric system, useful alike in anthropologic medicine and in medical anthropology; and this thesis presents a propounded and defended system of roentgen ray anthropometry useful to serve both the anthropologist and the physician in the common objective of the study of human evolution, development, transmission, classifications, effects and tendencies of man's bodily and functional differences."

The thesis is divided into four parts. Part I critically considers the technique of the investigation. Part II discusses the principles common to physical anthropology and to roentgen ray anthropometry and this is followed by the records of measures of anthropometric entities, such as diameters, angles and indices in a series of skulls. Part III includes the measures derived by the system of roentgen ray anthropometry elaborated, and contact prints of the skulls from which these measures were derived. Part IV is a bibliography, carefully compiled and of attested accuracy, having reference only to such articles as have a direct bearing upon the various topics in anthropometry presented in this thesis.

Radium and Roentgen Ray Therapy in Malignancy—Indications, Contra-Indications, Limitations and Recent Developments. Arthur U. Desjardins, M. D., J. Radiol., June, 1922.

IN this paper the inverse square law is first emphasized, since radiation is absolutely dominated by this law, and means of overcoming the handicaps imposed by this law are given. Filtration is discussed here also.

Indications, contra-indications for radium and roentgen ray therapy, combined treatment, metastasis, pre-operative and post-operative treatment form the subjects for the body of this treatise.

Recent developments in technique are much more briefly discussed and summarized.

Duodenal Bulb Deformity in Relation to Symptoms and the Chemistry of

the Gastric Juice. A. W. Crane, M. D., J. Radiol., June, 1922.

DUODENAL bulb deformity outranks every other x-ray sign of duodenal ulcer. Cole's serial method gives roentgen diagnosis the advantage over surgical exploration.

Accessory roentgen signs are relatively indecisive, yet bulb deformity, alone, is not sufficient for diagnosis. The history of the case and the chemistry of the gastric juice must be considered and the author tolerates no objection to this view. Carman and Holzknecht are cited in support of stomach analysis.

In the author's laboratory the last five years the stomach contents of about one thousand cases have been obtained by the Rehfuess method and most carefully and completely examined. Four types of curves were found, and though these bear a closer relation to symptoms than to bulb deformity, they are yet significant.

Four hundred and thirteen of the thousand cases showed a hyperacidity; one hundred and nineteen showed achylia. Diagnosis was: Duodenal ulcer, one hundred and twenty-six; gastric ulcer, twenty-eight; duodenal cancer, one.

These cases were studied by both x-ray and clinical methods. The fine art of taking histories is emphasized, too often they yield nothing of importance because not skillfully taken. In the absence of hyperacidity the presence of a history suggestive of ulcer, in a case of achylia, would lead the author to a search for other pathology. Diverticula, chronic appendicitis and cholecystitis may lead to a mistaken diagnosis.

Only twenty-five of these one hundred and twenty-six ulcer cases were operated. Operation was advised in many more, but prompt and satisfactory recovery under alkaline treatment as practiced by Sippey led to elimination of operation in many of these. Ulcer was found in nineteen of the twenty-five operated. In two cases, at the patient's request, the duodenum was not explored; in the remaining four cases three showed a persistent bulb deformity.

A sound diagnosis must be based upon ulcer history, hyperacidity, and bulb deformity. The use of the clinical record before x-ray diagnosis is urged.

Cancer of the Lip Treated by Radiation or Combined with Electro-Coagulation and Surgical Procedure. George E. Pfahler, M. D., J. Radiol., June, 1922.

ANY fissure or crust on the lip which lasts longer than a month should lead to the suspicion of malignancy and

this is where the general practitioner has a great responsibility. Early local destruction by electro-coagulation, followed by thorough radiation, should cure practically all such cases. Suitable selection must be made for electro-coagulation, and poor technique with this or any form of treatment will usually lead to failure. No matter what other form of treatment is employed, radiation must be used in all cases of cancer of the lip, care being taken to ray the lymphatics which drain the diseased area.

Recurrent carcinoma gives much less satisfactory results. Metastatic lymph nodes should be treated by surface radiation followed by implantation of radium or excision. The patient must be kept under observation for several years after final treatment.

Study of Hilus Pneumonias by Serial Radiographic Examination. L. R. Sante, M. D., J. Radiol., June, 1922.

SERIAL radiographic examinations of cases of atypical pneumonia, taken during the recent epidemic of influenza, revealed interesting data bearing upon cause, mode of invasion and prognosis.

Some of these types had never before been encountered by the roentgenologist, and to determine whether they were peculiar to the epidemic serial radiographic examinations were since then made of all atypical cases coming under observation.

The different types of consolidation encountered in this work are considered separately and notation made as to age in each case. One type, an acute inflammatory type, and another which had milder constitutional symptoms and was more protracted in its course, gave quite similar radiographic characteristics. The tuberculous type is given considerable space in the consideration.

The author sums up the pertinent points thus: "In short, a pneumonic process of inflammatory type may involve the hilus region in either children or adults. Such involvement may terminate in complete and rapid restoration to normal in either case. Where a previous tuberculous process is present in the hilus, the inflammatory reaction may be sufficient to activate the old quiescent lesion. In children the less confined character of a tuberculous lesion produces a more diffuse reaction, while in adults the heavy barrier of fibrous tissue about the lymphatics and the caseous lymph glands offers a better field for local disintegration and cavity formation."

Some Clinical Observations of Radium Therapy. C. W. Hanford, M. D.,

Med. Rec., April, 1922, p. 173.

AT first only advanced and inoperable cases of malignancy came to the radium therapist, but the remarkable results with these cases soon opened a much wider door. John G. Clark and other gynecologists are now quite definite upon the point of the more than potential supremacy of radium and the x-ray.

The author grants the distinct place of surgery in malignancy, but protests against blind adherence to it, and insists that when it is used it should be accompanied by radium and x-ray.

For the benefit of those in general practice, not yet fully informed in regard to radiotherapy, the effect of radiation upon malignant tissues, and tumor absorption, are discussed.

The question of whether radium is a cure is squarely and honestly dealt with.

In breast surgery the author does not agree with Beck that radium by the open wound method should be used, for he does not believe that the theory that toxins are stored up is by any means proved as yet.

In rectal carcinoma he believes that a colostomy should be done first, followed by radium application to the cancerous lesion, and this followed a week later by extirpation of the growth, this to be followed by postoperative treatment. No satisfactory end result can be promised. The palliative effects of radium can be relied upon in these cases, however.

In carcinoma of the bladder malignant papillomata are cured by radium. The writer uses six hundred mg. hours per each two square centimeters of involved tissue, gauze being placed between the tube and the area radiated. True infiltrating carcinoma of the bladder is rarely, if ever, anything but hopeless with any means of treatment.

In esophageal cancer radium has accomplished some clinical cures and gives palliation. With more perfect technique and more exact dosage there will come greater success in dealing with this lesion. From his experience the author believes that twelve hundred mg. hours (held in place twenty-four hours by carrier) is the proper dosage and that smaller doses should not be used.

In hyperthyroidism radium has proven itself to have decided merit. Some cases, of course, must go to the surgeon. One twenty-four hour treatment with needles imbedded to give a dose of 1440 mg hours is usually sufficient.

In carcinoma of the prostate favorable results have followed radium therapy. This is combined with surgery,

the dosage being one thousand mg. hours for each lobe.

Radium is a specific in uterine hemorrhage. Interstitial fibroids may be reduced by its use, but the hard nodular subserous fibroid calls for operation.

The closing paragraph is a discussion of Levin's findings regarding the effect of radium upon lymphocytes.

Radium Therapy. By Frank Edward Simpson, M. D., professor of Dermatology, Chicago, Polyclinic; Adjunct Clinical Professor of Dermatology, Northwestern University Medical School; Attending Dermatologist to Mercy Hospital, Alexian Brothers Hospital, Henrotin Hospital, etc.; Former President American Radium Society; Former Vice-Chairman, Section of Dermatology and Syphilology, American Medical Association; Director of The Frank Edward Simpson Radium Institute. Octavo, 391 pp. 166 original engravings. 1922. C. V. Mosby Company, St. Louis. Cloth, \$7.00.

THE technique of the preparation of radium emanation for therapeutic use and the method of measuring its gamma ray activity is given about the same space occupied by the first three chapters combined. The Debiere-Duane apparatus is illustrated and described in detail. A definition of "radioactive substance" is next given and the physics of the alpha, beta, and gamma rays are briefly discussed.

Absorption and filtration of the rays is given a brief chapter, followed by twenty pages upon the absorption of gamma rays in water. Here the author gives the results of his own experimental work on the absorption of gamma rays; the main problem studied was whether the scattering of the gamma rays causes any change in the intensity of the rays at various depths below the surface of the skin. Charts, diagrams, and tables illustrate the wealth of detail given in this chapter.

In the discussion of the physical and chemical effects of radium rays a paragraph each is given to the ionization of gases, penetration of opaque matter, production of heat, emission of light, phosphorescence and fluorescence, photographic action, and the coloration of various substances; other chemical effects are mentioned.

A thirty page chapter on the biologic effects of radium rays reviews the results secured by various investigators and this experimentation all has a direct bearing upon the therapeutic uses of radium. The effects upon bacteria, seeds, and plants, lower forms of animal life, various tissues of higher forms of animal life, hemopoietic organs, various

glands, the blood, nervous system, and upon the eye are here included and are described macroscopically and histologically. The lethal and stimulative effects of the rays upon malignant cells are discussed and immunity, with respect to malignant growths, is the subject of the last two pages of this chapter, and is followed by a short chapter upon the reactions from surface radiation and from intratumoral radiation.

Therapeutic apparatus, dosage and technique are then taken up; the first and last of these topics being described with the aid of illustrations. The discussion of the last topic is limited, mainly, to that of the different principles involved.

The subject of dosage occupies thirty pages of expository and descriptive text, seven of these, approximately, give space to tabulations, the value of which may be illustrated by the following verbatim excerpt: "While the number of 'milligram hours' may be easily found by multiplying the number of mg. used by the number of hours of exposure, the problem is not so simple when one wishes to compute the number of 'millicurie hours,' on account of the decay of the emanation, which loses approximately sixteen per cent of its activity each twenty-four hours. It is of importance, therefore, to determine the amount of emanation with which it is necessary to start a given interval (treatment) in order to have a given mean value during that interval. This is shown in Table XXIX." There follows this the time of application in hours, from one hour to forty-eight, with the corresponding number of millicuries necessary to start with in order to have a mean value of one hundred.

The second half of the book deals with the therapeutic uses of radium and has a chapter each upon the following subjects: Radiation in Gynecological Surgery; Radiation in Dermatology; Radiation in Ophthalmology, Otolaryngology and Rhinology; Radiation in Diseases of the Ductless Glands; Radium in Internal Medicine. In this last chapter the topics discussed are the following: the administration and elimination of radium, physiologic effects of radium, morphologic changes caused in tissues by radium, therapeutic indications. In all these chapters the pathology, technique and dosage for each case are described.

Approximately eighty plates, many of which are double, and thirty illustrations of lesions, including some histological studies help to drive home the subject matter of the text and are excellent reproductions.

The closing chapter is upon professional injuries due to radium, and takes up the local and constitutional effects of radium and suggests various protective measures and devices.

The bibliography consists of fifty-eight pages of eight point type covering the French, German, and English literature upon this subject from 1903 on, and is, of course, of great value in itself.

Standardization of Dosage Factors. H. J. Ullmann, M. D., Santa Barbara, Calif. J. Radiol., May, 1922.

IN the average laboratory there is a great deal of carelessness and inaccuracy apparent, which is dealt with specifically in this paper. The writer suggests that much of the variation in effects found by different workers, who

supposedly are using equal dosage factors, is due to actual variations in the factors themselves, to inaccurate measurements and differences in nomenclature.

The physical factors of voltage, filtering, volume of current, time, distance, and size of area treated are discussed and the question of measurement is taken up for each of these separately.

He concludes: (1) The methods commonly used in practice to measure the physical factors of an x-ray dose are grossly inaccurate. (2) Much or most of the work being done on the biological effect of radiation is either valueless or must be repeated with properly controlled physical measurements before the differing results can be correlated. This applies even more strongly to clinical measurements. (3) Many variations in effects reported by different observers would probably cease to exist if their physical factors, within reasonable limits, were the same. (4) When roentgenologists realize these facts and adopt uniform methods of measuring and recording, the records and observations will increase in value in proportion to their uniformity, and, when sufficient accurate data has accumulated it will be found that many of the discrepancies reported by the different workers will cease to exist.

ERRATUM

IN the May issue of the Journal, page 207, the abstract "The Possible Relation of Secretion to Cancer," contains a typographical error, in that the word "secretion" appears throughout the abstract instead of "secretin."

STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION, ETC. REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912. Of Journal of Radiology, published monthly at Omaha, Nebraska, for April, 1922.

STATE OF NEBRASKA) ss.

COUNTY OF DOUGLAS)
Before me, a Notary Public in and for the State and County aforesaid, personally appeared Herbert S. Tyler, who, having been duly sworn according to law and deposes and says that he is the Business Manager of the Journal of Radiology, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

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Sworn to and subscribed before me this 31st day of March, 1922.

(SEAL) CARL T. SELF,
Notary Public.
(My commission expires March 25, 1925)

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A Study of Legg's Disease, with Report of Cases*

ROY G. GILES, A. B., M. D.

Boston, Massachusetts

UNTIL the presentation of Arthur T. Legg's ⁽¹⁾ article "An Obscure Affection of the Hip-joint," before the American Orthopedic Association in 1909, such cases were usually diagnosed and treated as tuberculous coxitis. This mistake is still often made, and much has been written under various headings, but little has been added to Legg's original article. To him belongs the credit for the discovery of the disease known as osteochondral trophopathy of the hip-joint, osteochondritis deformans juvenilis, Perthes' disease, a particular form of coxalgia. Calve's disease, quiet hip disease, etc.

In July, 1910, Jaques Calve ⁽²⁾ presented ten cases of a similar nature under the caption, "A Particular Form of Coxalgia." These cases were selected from five hundred of his original cases previously diagnosed coxalgia. The same year Perthes ⁽³⁾ of Tubingen presented cases of this disease as "Arthritis Deformans Juvenilis." Although this paper was not published until after that of Legg, this condition is generally known as "Perthes' Disease." Taylor ⁽⁴⁾ has described this affection as "Quiet Hip Disease."

Many theories have been offered pertaining to the etiology of osteochondral trophopathy of the hip-joint. Heredity, obscure infection, faulty metabolism, syphilis, and traumatism have each been suggested. Calve ⁽²⁾ Schwartz ⁽⁵⁾ and Eden ⁽⁶⁾ have noted the hereditary character of this affection.

Frederick C. Kidner ⁽⁷⁾ of Detroit, in a paper published in 1916, suggests "that it is really a mild infection of hematogenous origin of the neck of the femur at the epiphyseal region." Legg likewise in his original paper cites one case in which an operation was performed and a septic focus curetted from the neck of the femur. He believed this focus to be only a coincidence and in no way responsible for the changes in the head and neck of the femur.

Delitala ⁽⁸⁾ believes we must look for the origin of the disease in, "a congenital alteration either of the epiphyseal cartilage of the upper end of the femur or of the epiphyseal nucleus, which gives away to processes of ossification which are insufficient and irregular."

Calve ⁽²⁾ suggests that rachitic conditions cause disturbance of metabolism by deforming the bony structures in the hip, and are likely the first source of the disease.

Perthes ⁽³⁾ removed from one of his cases at operation a small section of bone, cartilage and synovial membrane from the head of the femur. This specimen showed an overgrowth of abnormal cartilage which extended down into fairly normal bone. This experiment has been of little value, since the specimen was removed from a region which the x-rays showed to be little affected.

In 1917, P. W. Roberts ⁽⁹⁾ of New York, published an article in which he says, "traumatism, obscure infection, and perverted metabolism have each had their advocates. Tuberculosis has been eliminated because the joint recovers with good function, and syphilis has been eliminated because the Wassermann reactions are negative." In spite of the laboratory tests he cites two cases in which the x-ray findings seemed typical of osteochondritis and which had been treated for tuberculosis over a period of many months without improvement. These cases showed, in their teeth, evidence of inherited syphilis and very promptly responded to mixed treatment. In 1919, he reported ten other cases which he considered to be congenital syphilis and which had been diagnosed osteochondral trophopathy of the hip-joint. Not only was there rapid subsidence of acute symptoms under mixed treatment, but of eight bloods tested with cholestrinized antigens all were positive. Most every disease of the bone diagnosed by means of the x-ray has at some time during its etiological discussion, had syphilis offered as a causative factor.

Allison ⁽¹⁰⁾ opened the hip-joint of rabbits, producing a moderate trauma, but was unable to bring about a condition simulating osteochondral trophopathy in children.

Most writers agree that sixty-five to seventy per cent of these cases give a definite history of trauma. Zaaiger ⁽¹¹⁾ calls attention to fifty-five cases reported in the literature in 1914, sixty-six per cent of which gave a definite history of injury. Legg ⁽¹⁾ offered no opinion in his original article as to the cause of this disease, but noted that the occurrence of a traumatism was definitely related in time to the appearance of the limp. In 1916, he presented fifty-five cases, sixty-eight per cent of which gave a definite history of trauma. He divided these cases as follows: (1) cases of known trauma, (2) cases of operative trauma, (3) cases in which there was no history of trauma.

In cases of known trauma thirty-eight per cent of the fifty-five cases gave a history of injury, and fifty per cent of these came in for treatment from six months to four years after the limp was noted. Boys were more frequently affected than girls in the proportion of nine to one.

Of the fifty-five cases, thirty per cent gave a history of operative trauma, following the reduction of congenital dislocation of the hip. According to Legg, this condition occurs more frequently in girls than in boys, and there was only one boy affected in this group of seventeen cases.

Likewise, thirty per cent of the cases gave no history of trauma, but the affection, the end result, the x-ray, and the clinical findings were the same for both groups. For this reason he thinks that, due to personal variations, both as to memory and accuracy, the patient or the parent failed to report the injury in relation to the onset of the symptoms.

On account of the frequent history of trauma, Legg ⁽¹⁾ has concluded that the atrophy in the epiphysis, the loss of substance in the sub-epiphyseal region, and the hypertrophic thickening of the neck of the femur, are due to

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

porting circumstantial evidence to the idea of traumatic origin."

Most writers agree that this affection occurs between the ages of five and ten, with an extreme range of two and one-half to twelve, as given by Legg. Osteochondral trophopathy of the hip-joint usually occurs unilaterally, but most writers report cases of bilateral involvement.

There is usually a very insidious onset, and the only symptom in evidence is a limp, which is most often associated with trauma. It appears from six to thirty-six months after the injury. Unlike tuberculosis, at first there is no spasm and mobility is only slightly impaired, but later there is limitation of motion, most marked in abduction and external rotation, and flexion is unaffected. There may be some spasm in attempting forced motion. Pain is entirely absent or slight, though exaggerated movements of the hip-joint cause pain of slight degree. Night cries usually do not occur in this affection. The majority of the cases show evidence of slight atrophy of the epiphysis and of the neck of the femur. We often get shortening of one-quarter to one-half an inch, and the trochanter is most frequently elevated and may be prominent.

The children usually give a previous record of good health and are often very active. There is little or no pain, no previous condition of disease, and no sign of active infection. The activity, development and growth of the child are usually not affected. As a rule the patient's history is negative, but the ordinary diseases of childhood occur in various individuals. There may be no family history of tuberculosis or syphilis, and the Von Pirquet and Wassermann tests may be negative.



Figure I.—Case I.

derangement of nutrition brought about by interference in the blood supply following traumatism at the epiphyseal line.

Legg ⁽¹⁾ says: "The traumatic conception of etiology is excellently supported by the history of the disease itself. If one reviews the facts of occurrence and course, it is found that a spontaneous affection in a joint arises without, so far as can be determined, any systemic or infectious disease-producing cause. An initial mild acuteness,

as far as symptomatology is concerned, passes through a gradual self-reparative process and gives generally an end result, frequently without any assisting treatment, of a slight persistent limp and motion limitation, or a perfect recovery. Such a combination of onset, cause, and end result, is typically traumatic and the strictly accessory nature of the treatment is quite similar to that which is possible in cases of more serious traumatism. * * * The proportionate occurrence in boys is very marked in all reports, and lends sup-



Figure II.—Case I.

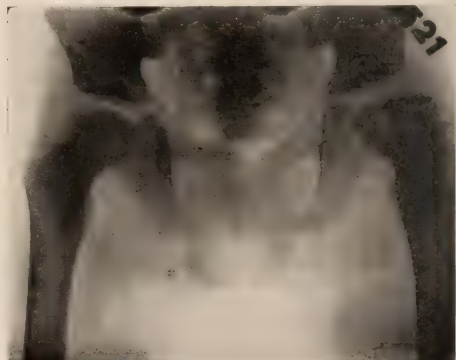


Figure III.—Case III.—Same case as shown in Figure II, nine months later.



Figure IV.—Case II.—Same case as shown in Figure 3, three months later.

The progress of the disease is from six to twelve months, with an abatement of symptoms after one to two years. Recovery occurs with a remodeled joint, but with excellent function. After the symptoms have disappeared there remains only a slight restriction of motion, and the characteris-

tic x-ray findings to identify the process. Ankylosis, restricted flexion, and limited abduction, seen so commonly after recovery from tuberculosis, usually do not occur in osteochondral trophopathy of the hip-joint.

The roentgen appearance is characteristic of this disease. Holmes and

Ruggles⁽¹²⁾ describe the x-ray findings as, "a flattening and mushrooming of the head of the femur, suggesting tuberculosis, but without typical clinical signs. The joint is not involved. There is little bone atrophy and interference with growth is not marked." They describe tuberculosis as follows: "It causes a slight enlargement of the soft parts, effusion in the capsule and general haziness and muddiness of the entire joint area. There is extreme decalcification, so that the outline of the bones may be reduced to thin penciled white lines. Enlargement and squaring of the epiphysis are seen, and later more or less destruction of joint surfaces, and interference with the growth of bone. There is no new bone formation. The occurrence of periosteal reaction and bony ankylosis in these joints is the result of secondary infection. During the process of repair there is increase in density due to the deposit of lime salts."

All writers agree that very little treatment is necessary, since the disease is self limited and tends to spontaneous cure. Blanchard⁽¹³⁾ of Chicago says, "early and continued mechanical treatment that protects the head of the femur from weight bearing, jar and concussion, will usually preserve the head in its rounded shape, but observation of a number of treated and untreated cases shows that the best available mechanical treatment has little or no effect in preventing or causing atrophy of the bone and muscles of the leg of the diseased side." Legg⁽¹⁾ states, "the healing process tends to come about naturally, and by watching the patient and affording any accessory, which dimin-



Figure V.—Case III.



Figure VI.—Case III.—Same case as shown in Figure V., seven years later.

ishes strain upon the hip to facilitate recovery by means of repair, is all that can be done."

Case I.—J. B., male, age six, complained of pain in the left hip, and his parents noticed a slight limp about one year before the roentgenograms were made. He did not give a definite history of injury, but had always been strong and active. There was no family history of tuberculosis or syphilis and the Von Pirquet and Wassermann reactions were negative. He had no constitutional symptoms. Flexion, abduction and extension were only slightly limited. In July, 1920, the boy was a perfect picture of health and his limp was scarcely noticeable. His father would not give his consent to a second radiographic examination. Fig. 1 (July, 1914): Roentgenogram shows the head flattened, epiphysis thin, joint surface not affected. The right hip is normal.

Case II.—R. S., male, age nine, complained of pain in the left hip and began to limp soon after a fall from the barn loft in May, 1918. He gave no family history of tuberculosis or syphilis and did not have fever or night sweats. One year after the fall from the loft (May, 1919) the limp was much more noticeable. A physical examination at this time showed one-half inch shortening, atrophy of the calf and thigh, lack of symmetry of the gluteal fold, and a slight limitation of flexion, abduction and hyperextension. Fig. 2. (May, 1919): Radiogram shows flattening of the head and thickening of the neck of the femur. The joint space is smooth in outline and is not involved. Fig. 3. (February, 1920): There is

increased flattening of the head and spreading of the epiphysis and beginning changes in the neck of the femur. Fig. 4. (May, 1920): Shows progressive flattening of the head and moderate thickening of the neck of the femur on the left and on the right. The joint spaces are smooth in outline and are not involved. The epiphysis on the left is flattened to such an extent that it has become very small and thin, and the surface is somewhat irregular in outline. The flattening and mushrooming of the head and the increased thickness of the neck of the femur of the right hip, shows about the same degree of change or deformity as the left hip did one year ago, when the right hip was normal.

Case III.—H. S., male, age thirteen, began to limp about eighteen months before the roentgenogram was made, and during this period he was treated for rheumatism. He had always been very strong and active. He fell from an ice wagon about four years before the limp was noticed. He complained of slight pain during the night, but had no pain during the day while up and playing. He did not have a family history of tuberculosis, or syphilis, and had no constitutional symptoms. The Von Pirquet and Wassermann reactions were negative. In August, 1913, he weighed eighty-five pounds, and in July, 1920, he weighed one hundred and sixty pounds. The terminal stage leaves him a good functional hip, and he leads a very active life. He swims, dances, play base ball, foot ball and tennis. Physical examination seven years (July, 1920) after symptoms were noted, showed the great

trochanter slightly elevated and prominent. There was one inch shortening; abduction, flexion, extension and internal rotation were slightly restricted. Fig. 5. (August, 1913): Roentgenogram shows a flattening, thinning and diminution in the size of the head and a moderate degree of shortening and thickening of the neck of the femur. The outline of the joint space is smooth and is not involved. The left hip is normal. Fig. 6. (July, 1920) taken seven years later, shows the terminal stage as a flattening and spreading of the epiphysis which is displaced slightly in all directions on the neck. The joint surfaces are smooth and not involved.

CONCLUSIONS

Osteochondral trophopathy of the hip-joint, Legg's disease, Calve's disease, Perthes' disease, etc., is a definite clinical entity, which should not be confused with other diseases of the hip-joint.

If Legg's disease occurs in other joints than the hip, it has not yet been recognized as such.

A number of conditions may be responsible for the disease, but it is generally conceded that sixty-five to seventy per cent of the cases follow an injury.

It occurs between the ages of five and ten, with an extreme range of two and one-half to twelve.

The course, symptoms, radiograms and end results are characteristic of this affection.

The treatment is simple and the prognosis good.

The disease is self limited and tends toward spontaneous cure.



Figure VII.—A case of Legg's Disease.



Figure VIII.—A case of Legg's Disease.

In conclusion, I wish to express my appreciation to Drs. J. M. Martin and C. L. Martin of Dallas, Texas, for their aid and instruction in the preparation of this paper.

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The Use of Radium Needles in the Treatment of Cancer*

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I AM almost ready to believe that any case of cancer can be cured. Whether or not any particular case is cured, depends, more than any other thing, upon its ready accessibility to agents at our command.

Of all agents which have been used in the past, surgery has certainly held the center of the stage. The prominence given the knife has not been through any inherent efficiency, but for lack of a more efficient agent at our disposal. However, radiation therapy has advanced so rapidly in the last few years in the treatment of this disease that

cancer should no longer be considered a surgical disease.

Surgery still has its place, but it should be considered as an adjunct to radiation therapy. The one inherent weakness of the surgical method is that it opens up the lymphatic vessels and allows the cancer cells to escape into the surrounding tissue. Entirely too much healthy tissue is always sacrificed in the surgical treatment of this disease.

Radiation therapy blocks the lymphatic vessels, preventing the escape of the cancer cells; moreover, it can be used over large areas, without seriously injuring the tissues treated.

In the treatment of cancer by radiation, whether by x-ray or radium, two things are necessary: First, the lym-

phatics draining the diseased area must be closed, and second, the cancer cells must be destroyed.

Blocking of the lymphatic system is accomplished comparatively easily with the x-ray, which I believe is preferable. Radium will accomplish this result, but its application over a large area is rather slow and tedious. In giving these treatments with the x-ray there is very little danger of injuring the skin if reasonable precautions are taken. The second step, that of destroying the cancer cells, is, however, not a simple procedure.

Any cancer cell can be killed, either by x-ray or by radium. Our problem is to expose the cancer to sufficient radiation to destroy the cells, but not

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

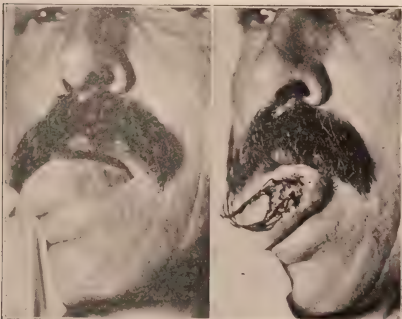


Figure I.—Cancer of the tongue, one and one-half inches long and one inch wide. Was electro coagulated, after injecting procaine. Fifty milligrams, in five needles were inserted, through the base of the burnt tissue and left five hours. At the end of two months, completely healed.



Figure II.—Cancer of the lip, with some thickening of the glands of the neck. Heavy x-ray treatments over the lymphatics of the neck, with electro coagulation and insertion of radium needles. Complete recovery.



Figure III.—Cancer extending through the cheek. There was a growth on the inside of the cheek, similar to but only about one-third as large as that on the outside. Both the inside and the outside were treated by electro coagulation burning the tissue down. Radium needles were then inserted, as shown above. Healing took place without perforation. At no time was there any opening through the cheek.

to injure the normal tissue beyond its ability to recover.

The one tissue which stands in our way more than any other in the treatment of this disease is the skin. It is well known that some cancer cells require more radiation to kill them than the skin can reasonably stand. This led to cross-firing, or treating the disease through several different skin areas. This proved satisfactory in some cases, but not in others. Removing the skin over the diseased area is unnecessary and should practically never be done.

Our problem is to give the cancer cells a death dose, or we might say, give the cancer cells the largest dose of radiation from which the surrounding healthy tissue will recover. This can best be accomplished by using a combination of x-ray and radium, giving x-ray on top of the skin, all it will stand, and radium underneath the skin to the limit of what the deep structures will stand. Or we might say, x-ray

from without in, and radium from within out. In this way the cancer cells are caught within a cross-firing from which few will ever escape.

How big a dose of radiation should be applied, and when? Biologists and pathologists tell us that certain types of cancer require a larger dose to kill the cells than others, but I have not always been able to judge correctly just which case is which. Sometimes the apparently simple cases prove to be very stubborn. Not always being able to judge beforehand, I give my cases the largest dose which the surrounding tissue will recover from.

When to give the treatment: I am coming more and more to believe that the maximum dose of radiation should be applied as early as possible, in practically one treatment. Not necessarily in one treatment, but close enough together that the cells do not recover between treatments. The sooner we kill, or, I might say, the shorter the time re-

quired to kill the cancer cell, the more likely we are of eventually curing our patient.

If we do not see a really wonderful improvement in four to six weeks, I feel that our chances of curing the patient are not very good. Our best results have really been spectacular. If we are going to cure our cancer patient, we must do it, and get it over with. Give the patient all the x-ray he can stand, either at once or over a period of four weeks. "Give," I might say as they did during the war, "till it hurts," and then stop. The practice of giving treatments once a week, or every two weeks, over a long period of time, is all wrong. The normal tissue will stand large doses of ray over a short period of time, but will not stand even small doses indefinitely. We all know this, few of us practice it. These cases must be treated almost as a surgical case would be treated, the cancer



Figure IV.—Extensive involvement of the lower lid, extending back into the orbit. Tissue was thoroughly destroyed by electro coagulation and curetted away. Seventy milligrams, in seven needles were evenly distributed throughout the tissue. Later it was found necessary to enucleate the eye, patient doing nicely at the present time.



Figure V.—Extensive involvement of the eye and orbit. The eye was enucleated and all the involved tissue destroyed by electro coagulation. Eight needles were imbedded as shown in the radiograph. Completely healed, no recurrence.



Figure VI.—Fibro-Mixoma in front of ear. Had been operated twice. Heavy treatment on the outside, with one hundred and fifty milligrams, in fifteen needles, imbedded on the inside, for five hours. There was considerable reaction, which subsided at the end of three weeks. Tumor promptly melted away.



Figure VII.—Paget's disease, with deep involvement. There was a mass to the right of the nipple, about three by two inches. One hundred and forty milligrams, in fourteen needles, were imbedded, as shown in the radiograph, and left in place for five hours. This was followed the same day by heavy x-ray treatments over the breast and glands draining it. Completely healed. Later there was a slight recurrence, which is being treated by x-ray, at the present time.

cells being destroyed *in situ* by radiation rather than being cut out.

Long continued treatments may apparently remove the tumor, but the tissues may be so weakened that we get what might be called a reversal of the tissue, and the disease spreads like wildfire. We have seen cases where we thought the patient almost well, when perhaps small nodules began to develop, or the tissue broke down, and away went the patient. The condition reminds me of what happens in a storage battery if strained too much when nearing its discharge point, the polarity changes and away goes the battery.

So to apply the dose of radiation which will destroy the cancer cells within the shortest space of time, and yet not do irreparable damage to the

normal tissue, I proceed as follows: All the diseased and surrounding tissue, together with the lymphatic vessels draining the area, are given all the x-ray the skin will stand, with heavy filtration; cross firing is used whenever possible. From six to ten millimeters of aluminum, with leather, are used as filter; nine and one-half inch back up; five milliamperes, at ten inches distance, for from twenty to thirty minutes. This dose is followed either the same day, or the next, by the use of radium inserted into the deep tissues.

Radium needles of ten milligrams each are inserted deep into the cancer tissue one centimeter apart and left for a period of from five to ten hours, the time depending upon the kind of tissue, generally speaking, as to whether it is

hard or soft; if the tissue is soft and boggy and almost ready to break down, five hours, or even less, is sufficient.

The insertion of radium in the form of needles is a surgical procedure and should only be undertaken by one who has had a surgical training. Most of the operations can be made under local anesthesia; however, a strict aseptic technique must be followed. Cancers which are infected break down readily and do not do well.

The manner in which the needles are placed in the tissues must be worked out for each case. It is important to see that the needles are not "bunched," thereby over-dosing a part of the tissues. I make radiographs of all cases so as to show the distribution of needles within the tissues. This is particularly important in mouth cases, so as to be



Figure VIII.—Cancer on the inside of the mouth, involving the cheek, gums of the lower jaw and roof of the mouth. Heavy x-ray treatment over the outside, with electro coagulation and ten radium needles on the inside which were left in place for four hours. At the end of two months, a slight recurrence was treated in the same manner. Completely healed at the present time.

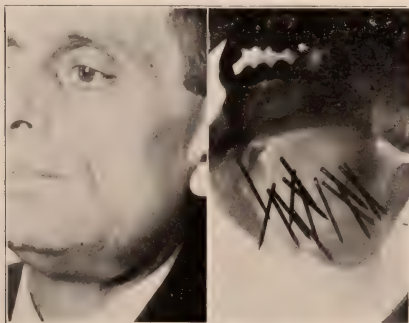


Figure IX.—Swelling of the left lower jaw, with extensive destruction of bone. Heavy x-ray treatments over the outside, with one hundred and fifty milligrams of radium, in fifteen needles, imbedded into the cancerous tissue through the mouth, as shown in the radiograph. At the end of one month, several pieces of bones were removed from the inside. At the end of two months, odor practically stopped and patient gained considerable weight. Is steadily improving.

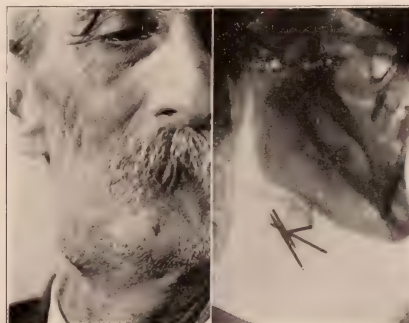


Figure X.—Patient had previously had cancer of the lip, with recurrence under the jaw. Heavy x-ray treatment, with fifty milligrams of radium, in four needles, imbedded for five hours. At the end of two weeks nothing could be felt. It is remarkable how rapidly these recurrences in the neck will disappear, under the combined method.

sure that none of the needles have become dislodged and swallowed, where they might burn the esophagus and later result in a stricture.

The preparation of the radium needles is important, but I fear that sufficient attention has not been given this subject. Above all, the needle and its thread must be sterile; this can be accomplished by placing them in alcohol, but better yet, they can be boiled. And there is no reason why radium needles cannot be boiled, provided they are not allowed to boil dry; and where is the man who is going to allow, for instance, \$18,000 worth (only fifteen needles) to boil dry.

Perhaps more important than even the sterilization of the needles is their preparation. We have had a long list of martyrs to the cause of x-ray therapy, and I hope we will profit by their fate and be more cautious in the handling of radium.

If we but remember that each little innocent looking radium needle is full of potential harm and ready to "go off", so to speak, at the slightest touch of the trigger, then, and only then, will trouble and suffering be avoided.

How are we going to thread, say fifteen needles, and what are we going to put them in while being sterilized, and how are we going to keep the threads from becoming tangled, and how are we going to get hold of them

with the imbedding forceps, and, above all, how are we going to protect the operator while all of this is being done?

A simple contrivance has been worked out which answers all the above requirements for the handling of the radium needles. It consists essentially of a lead block into which holes have been drilled to a depth which will allow the eye to protrude when the needles are inserted. The needles are placed into their respective holes and can then be threaded without any trouble, the thread being held with a pair of forceps. The lead block protects the operator while the needles are being threaded. Projecting some five or six inches from the block is a brass frame, which serves as a carrying handle, and into this frame slots are cut which serve to hold the thread from each needle separately. A part of the lead in the block is cut away so that the sterilizing fluid will have ready access to the needles.

After the needles are placed in the holder and threaded, the entire container is placed into a deep glass dish filled with alcohol, or it may be boiled.

When a needle is wanted for imbedding, its thread is loosened from the slot, and the needle lifted part way out of its hole by the thread. The needle then can readily be grasped with the imbedding forceps. The use of this apparatus certainly simplifies the use of

radium needles, and at the same time protects the operator, which is quite necessary if we are to continue our fight against cancer.



Figure XI.—Patient had a large sloughing mass on the back part of the tongue. Four radium needles were inserted into the base of this mass, from behind forward. Insertion of these needles was extremely difficult. A radiograph was then made, as in all cases, and one of the needles was found to be lying in the esophagus, from which place it was immediately removed and reinserted. The importance of taking x-ray pictures of all mouth cases where needles have been imbedded cannot be overestimated. Patient made a perfect recovery.

The X-Ray as a Microscope*

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IT is not my intention to attempt a paper on research, or to endeavor to present new facts, but rather to analyze and call attention to certain data well known to all of you. The field of the roentgenologist is growing so large and assuming such proportions, that a discussion of the general principles involved may be of value. In fact, I feel that such a discussion is becoming necessary. I am surprised every day at the lack of knowledge of the field of roentgenology evinced by the medical profession. We have been so busy making new discoveries in our line, that we have overwhelmed the medical profession and the laity with mysteries without giving them the basis of our work.

The discovery of the x-ray by Professor Roentgen in 1895 followed as the proper sequence to the scientific investigations of several men. In 1858-59, Heinrich Geissler began his ex-

periments with the vacuum tube. The first tube was of comparatively low vacuum (about 0.0025 mm.) and the electricity discharged through it produced a delicate glow. Geissler discovered that in the pressure vacua of different gases, the electrical discharge was very different from that of air; also that the electricity was sometimes striated and varied much in form and color with the degree of exhaustion and the composition of the gases. In 1860 Hittorf followed with the discovery that the luminous stream could be deflected by a magnet.

Then came Crookes, to whom, it is probable, belongs most of the credit for the preliminary work which made the discovery of the x-ray possible. He devoted himself to the production of a high-vacuum tube, and achieved one in which the pressure of the residue of air was about one ten-millionth of an atmosphere. With this tube he discovered new phenomena. He found that with a sufficiently high vacuum, the illumination glow within the tube

disappeared, and he demonstrated that there was a rectilinear radiation from the cathode which was a production of particles of highly attenuated gas at exceedingly high velocity, about two hundred and fifty thousand yards per second. He called these rays *cathode rays*, and spoke of the condition of the gas in this highly rarefied state as the "fourth or radiant state of matter." Crookes also discovered that the rays could be intercepted by metallic plates within the tube, and that the impact of the rays against the walls of the tube produced a greenish phosphorescence or fluorescence and increased the temperature.

The next step was the announcement by Hertz in 1887 that when ultra violet light falls upon a spark gap, the discharge is facilitated; and again in 1892, that the cathode rays would penetrate gold-leaf and other thin sheets of metal within the tube. After his death his work was carried on by his assistant, Lenard, who discovered that many of the phenomena of the

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

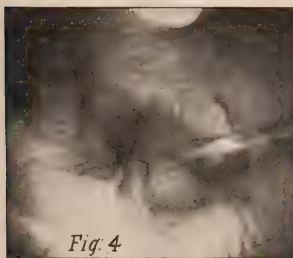
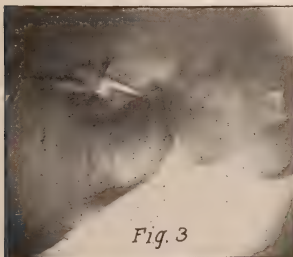
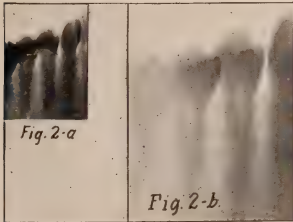


Figure I.—(a)—Reproduction from an ordinary dental film, with sharp detail.

Figure I.—(b)—Ordinary photographic enlargement from Figure I.—(a), as is commonly used in the study of minute detail.

Figure II.—(a)—Reproduction from ordinary dental film with small amount of blurring.

Figure II.—(b)—Enlargement from Figure II.—(a), illustrating the necessity of sharp definition for enlargements.

Figure III.—Pin-hole radiograph of skeleton foot with bones lying in apposition to film.

Figure IV.—Pin-hole radiograph made of same skeleton foot as in Figure III. The bones are here placed eighteen inches from film, thus cutting the direct rays from pin-hole, so as to produce the desired enlargement and yet retain detail.

rays could be observed outside the tube. He experimented with a tube closed at the end opposite the cathode with a thin sheet of aluminum, and found that the rays traveled better in vacuum than in air, that they produced phosphorescence in suitable materials, would pass through substance opaque to ordinary light, and would affect photographic plates.

In 1893 and 1894 H. C. Jackson of King's College, London, came very near making the great discovery. He made known to the world one of the greatest advances in this field. It was he who discovered that a piece of platinum used as a track for the rays, instead of glass, increased the penetrative power and number of the rays, and also that a sharper shadow could be obtained.

It was to Roentgen in November 1895 that fell the honor of making the discovery of the x-ray. This series of discoveries has led to such great advancement in science and in the care of the sick that they must be placed among the really great discoveries in medicine, such as anesthesia and bacteria.

Following the announcement of Roentgen's discovery, the news was spread broadcast over the world and machines were established in all the larger cities. Many workers began to play with these rays, endeavoring to make pictures of the bones and of foreign bodies. The exposures varied from a few hours to a half day. The fluoroscope was also used extensively, and as a result of this and the long exposures many patients were burned, and the doctors received injuries which in many cases proved fatal. We are still seeing the results of that period.

Following this enthusiasm over the x-ray there came a period in which it was much in disfavor. This was to be expected, as equipment was very crude and inefficient, and the results disastrous, the practical value being offset by the danger. Science, however, came to the rescue furnishing more powerful machines—the exposure time was decreased and the efficiency increased. So that for the past ten years x-ray examination in disease has been steadily gaining ground. The bismuth meal was added in the diagnosis of the gastrointestinal tract, and injection of the kidney was found to be of tremendous value. Portrayal of the diseased conditions of the lung by fluoroscopic examination and later x-ray plates was made possible. Gradually every part of the body and every known disease has been added to the list requiring x-ray examination, and every city and town has its large and small equip-

ments. In spite of the scientific investigations which led up to the discovery of the x-ray, and in spite of the electrical science which made available the more powerful machines, the x-ray has been considered a magic crystal-glass into which one may look and see the revelation of all the diseased conditions of the body. Let us then strip off every vestige of glamour and illusion and leave only the bare facts. Such consideration will prove that the x-ray is a portrayal of living anatomy and its physiological and pathological variations. Given a knowledge of these three, plus an understanding of the x-ray, one may prophecy what the x-ray picture will be in any given case.

Our study of anatomy must not only be broad as to the various systems of the body, but detailed as to each organ. The knowledge of anatomy gained by x-ray study has been considerable, and has changed our opinions in many cases, as regards stomach and intestines, for instance. It is necessary to know the epiphyseal line of the bones and the size of the normal kidney. In cancer we can do little without a knowledge of the lymphatic nodes and their drainage. The anatomy of the lung is very intricate, and yet its most minute variations must be thoroughly understood. The consideration of the physiology may be illustrated by the heart, stomach or the growth of normal bone. The stomach has certain emptying powers, certain peristaltic waves, definite shape and tone, and any variation of these may be a key to the diagnosis. The small intestine is formed in the lower portion of the ileum and passes rapidly through the jejunum. The variation here often points to the appendix. The heart has certain known action, and it is possible to suspect the aorta or one of the valves by the changes in shape, size and action.

In the early history of the x-ray, it was attempted to diagnose only gross pathology such as fractures, foreign bodies, and large tumors. Now nothing is too minute or too intricate to be shown. The mistakes that I have made, I find, have been due to a lack of knowledge of pathology. We can climb no higher than our knowledge of pathology, and it is this branch of medicine that tells us not only what to look for, but how to find it.

The practice of medicine, as well as every day life, is based upon facts learned by experience. The simple Eskimo coming into the Canadian woods, would have to be told that certain objects were trees. In like manner, the medical student is introduced to the rules of the chest. These observations are so ordinary that we consider

them as facts proven beyond doubt. And yet, how did we learn that a certain sound in the lung was a rale? If a patient comes in with loss of weight, cachexia, lack of appetite, indigestion, and a mass in the pit of the stomach, we consider it certain that he has cancer. Analysis of our conclusions shows that experience and observation have taught us that such a combination of conditions invariably points to cancer. The pathologist has made a prolonged and detailed study of all the various tumors of the body, and he is able, often, to state the kind of tumor from its gross appearance, and still more accurately from a section. In other words, he has found from experience, that a tumor of certain definite characteristics usually belongs in a certain definite class, and that it keeps these characteristics of the parent tumor no matter how far afield it may wander.

This same basis of reasoning is fundamental to the roentgenologist, and is decidedly within his province. In a complete examination he may make general deductions as to the pathology, just as the pathologist does from his gross examination, and also specific statements of findings in regard to any one part or organ. The general deductions, no matter how correct nor how much they are affecting the health of the patient, may not be the patient's chief complaint. The clinical history adds this necessary information, and is usually conceded to be within the field of the internist.

Our knowledge of the x-ray must be such that we will know what will be recorded upon an x-ray plate, and how to obtain it; that is, the rays have certain qualities and travel in certain directions and under definite conditions will portray any part of the body in its true likeness. The actual operation of the apparatus is entirely another matter, and is the true work of the technician.

May I, at this point, express my conception of the technician? Primarily, I feel the technician should be familiar with electricity, the running of an x-ray machine, and the x-rays as delivered by that machine. Likewise, he should understand the chemical phenomena that take place in a dark room and their general management. This requires intelligence and considerable scientific training. It is a position of great responsibility, inasmuch as it controls the quality of work done in the laboratory and relieves the roentgenologist of a tremendous burden. Familiarity with certain positions and the knowledge of correct exposure are also necessary requisites. If the technician is to leave this scientific field and offer

interpretation of the anatomy shown upon an x-ray plate, together with its physiological and pathological variations, he is then entering directly into the field of medicine. Not only that, but he is dealing with the fundamental subjects of medicine, and if he has sufficient knowledge of these subjects to draw conclusions from the x-ray plates, then I am in favor of giving him the doctor's degree. It is true that anyone interested in science can learn a great deal about the human body from his associations in an x-ray department, and it is equally true that one can study the subjects of medicine without attending a medical school. But such courses are not recognized by the medical profession at the present time. I claim that it is as necessary to have a knowledge of medical subjects in the interpretation of x-ray plates as it is to make a physical examination of the chest and interpret the sounds heard through a stethoscope. The stethoscope does not whisper "pneumonia" or "tuberculosis," but gives a sound recognized as a rale, which the internist from experience and study interprets as certain forms of congestion. This same reasoning and intelligence must be used in the study of an x-ray plate. If the roentgenologist will do the work of which he is capable he need not fear the technician. The evolution of the x-ray and education of the medical profession and the laity through propaganda will give him his true place. Regulation of the technician through a licensing board may be of help, but without the education of the medical profession and the laity, I feel that it would be a failure.

In the study of an x-ray photograph our first approach is that in regard to its general aspects. We note first whether it is a good picture correctly portraying the anatomy. A good picture has not only visible qualifications, but intrinsic values. Our next consideration is that of the gross pathology; any considerable area of disease is noted which will lead to general deductions. The older roentgenologists have been especially skilled in studying gross pathology and have been able to give certain shadows a place in the diagnosis, which others would overlook. The clinical history should be used as the guide to the taking of the picture, and in its subsequent study, as a teacher of what we have overlooked.

After general consideration of our material we often find it necessary to make a detailed study of some of the anatomy as portrayed. This study must often be very painstaking and a careful search made for any physio-

logical and pathological change. The information so gained may be the key to the diagnosis, and give us the etiological factor. This detailed study when often repeated leads us to desire better plates, more accurate portrayal of pathological conditions, and the ability to more closely study minute pathological conditions. The roentgenologist often uses an enlarging lens in this search, and several have stated that they are able to make more accurate diagnosis by enlargement, especially in the study of bone conditions. The question we then ask ourselves is, "How far will we be able to go in this study of enlargements?" Certain parts of the body yield themselves well to x-ray photography, and it is reasonable to assume that if we can properly control the rays we will be able to get pictures of greater intrinsic value and ones which will lend themselves more readily to enlargement. In the study of enlargements, I have found it hopeless to attempt anything with a blurred image, but one of sharp outlines can be magnified until the grain of the emulsion begins to show. We then have three main considerations:

First, the rays coming from the tube and their ability to cast a sharp shadow upon the plate;

Second, the ease with which the part of the body yields itself to photography;

Third, the limitations of the emulsion.

A few experiments in regard to the first may be of interest. We have only of late fully appreciated the part which the focal spot of a tube plays in the taking of an x-ray picture. Dr. Coolidge has given us a wonderful tube and focal spots of varying sizes, according to our needs. The rays coming from these tubes are not, however, under perfect control and cause more or less blurring of the image. A diaphragm with a pin-hole measuring one mm. as an opening was used beneath the tube; after various experiments with different tubes and different distances we came to the following conclusion:

First, that such a diaphragm cut off all undesirable rays from the tube and allowed those to pass through that were traveling in straight lines from the focal spot to the plate.

Second, that the size of the circle of radiation was increased as the pin hole was brought nearer to the focal spot.

Third, that the size of the circle of radiation was directly proportional to the size of the focal spot, that is, the larger the

focal spot the larger the circle of radiation.

Fourth, that the quality of the rays was not changed and the time of exposure was in the direct proportion of the size of the pin-hole to the size of the focal spot, that is, the broader the focal spot the longer the exposure, as fewer rays really passed through the opening.

Five, that an object placed at varying distances from the plate would be enlarged in proportion to the distance from the plate.

Sixth, that some focal spots gave off different quantities of rays from various places on the focal spot and cast shadows of varying densities.

It would seem possible to have such a diaphragm close to the anode, giving us a sufficiently large area of exposure to be used practically. The danger of

exposure would be no greater, as the quantity of rays coming through such an opening is correspondingly less. An object could then be placed at varying distances from the plate and enlarged as desired. This image could be studied still further with a hand lens to the limit of the emulsion. With the advent of still larger apparatus and the control of the secondary rays, which will eventually be accomplished, we can expect x-ray photographs of great intrinsic value.

DR. PARISEAU: I believe that we owe thanks to Dr. Wasson for calling our attention to one aspect of radiography that has been too much neglected—the fact that it acts as a microscope. We are greatly jeopardized by secondary radiations, but we can get around them with a small diaphragm. One should work with a slow plate and not the ordinary radiographic plate. The emulsion in this case is too

coarse to allow any magnification. I have found that certain plates like the imperial fine grain ordinarily have the same speed as x-ray plates and they are much less grainy for this kind of work. I think you would find under the microscope or enlarging glass, an emulsion much less grainy.

I think we shall have in time a developer that will be quite fluctuating. Then with a tube removed sufficiently far away and all secondary radiation suppressed, I think we can push that idea of yours farther still and get practically microscopic enlargement. We might call them photomicroradiographs.

The point I wish to emphasize is that by sacrificing a little speed, using slower plates when it can be done (it can be done for bone study), we get around the graininess of ordinary x-ray plates. I believe there is a line of research that we should all go into, that is, microphotography by the x-ray.

Some of the Less Common Uses of X-Ray Therapy*

C. E. RICHARDS, M. D.

Toronto, Canada

JUST as in much of our general medical work there is a tendency sometimes to devote too much attention to rare and unusual diseases to the exclusion of the common, every-day afflictions of the human frame, so in the stress of the great period of advancement we now find ourselves experiencing in roentgenology we may overlook some of the more homely uses of our wonderful agency. Therefore, this short paper is offered to call to our minds several diseases in which great things can be accomplished without first having to determine to the third decimal point the number of Angstrom units being produced by our particular apparatus at that particular moment.

The chronic or sub-acute infections are so many and varied and occur under such a variety of conditions that it would be impossible here to refer to them in detail, and yet it is the writer's opinion that almost any type of chronic infection will receive some degree of benefit from stimulating radiation. There are many, however, in which the results are so definite as to appear specific in their effect.

CARBUNCLE

The successful treatment of carbuncle by x-ray dates back almost to the earliest days of x-ray therapy, and yet so little has been said in our litera-

ture regarding it that operations are still being performed for this condition. There is probably no more satisfactory result in radiotherapy than the manner in which the average carbuncle responds to treatment, and the percentage of cures is so high that it should certainly be tried out in every suitable case.

Judging entirely by results, I would divide carbuncles into two main groups: (1) Those occurring upon the back of the neck. (2) Those elsewhere on the body.

In the first group treatment is helpful, but results are slow to appear and not very definite until the "core" has separated, after which healing is rapid. The general course of the disease is probably not greatly altered by treatment.

It is with the large spreading carbuncle upon the trunk, usually the back, that the best results have been obtained. These patients practically always present themselves for treatment after several craters have formed and are discharging pus, and at the same time the lesions are all extending and are very painful. In most cases the surgeon is contemplating a complete removal of the area and antiseptic compresses have been tried without avail.

We have never up to the present had to give more than two treatments to such a carbuncle, and usually only one. The technique followed has been satisfactory, but no doubt some other would serve equally well. The infected area is treated in one single large area

and is given three-quarters of an erythema dose unfiltered. This in our case is four milliamperes, ten inch distance, eight inch spark gap, three minutes. The pain will usually be relieved the same day, but in any case should not last longer than twenty-four hours. Improvement should also begin at once, but if necessary the same treatment may be repeated on the fourth day. Within a week the whole infection should be gone, and the area healed, or rapidly granulating upon a healthy base.

FURUNCULOSIS

If the furuncle can be treated in the very early stage, while it is still forming and before the occurrence of pus it is frequently possible to cause recession and prompt disappearance.

The patients who more commonly present themselves have suffered from chronic boils—usually for weeks or months, and have tried nearly every form of therapy from yeast to vaccines. In such cases we believe the disease can be dealt with more effectively by radiotherapy than by any other method and believe that it should be invariably recommended. It has been our custom to treat such cases both locally and systemically as follows:

The local treatment applied to the lesions is not different from that in carbuncle except that we give one-quarter of an erythema dose and repeat this each week until the desired result is obtained.

In addition, however, to treating the lesions directly we expose several large

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 8, 1921.

areas of the trunk to the same dose, believing that in so doing we materially raise the phagocytic activity of the blood and improve the patient's condition generally. Of the effectiveness of this addition to the technique we have no doubt whatever but have had no opportunity to make any study of the mechanism or to establish its virtue other than by empiricism and the known effects upon the body of such irradiation.

ONYCHIA AND PARONYCHIA

There is surely no more distressing minor infection than either of the above, and few things more intractable to treat under ordinary methods. They usually come after a prolonged period of antiseptic treatment with or without adequate drainage, and yet three exposures one week apart is the maximum amount of irradiation we have ever had to apply in order to secure complete cure of the condition. The technique is that used for carbuncles and repeated within four days to a week. We have also used the following with equally good results, but apparently not any better: five ma., two mm. aluminum filter, five minutes, ten inch distance, eight inch spark gap.

CHRONIC SINUSES AND FISTULAE

Chronic discharging sinuses, including tuberculous sinuses, respond well if the source of infection is in lymphatic, glandular or similar tissue, but no response has been obtained in fecal or urinary sinuses or fistulae. Up to the present the responses in sinuses in osteomyelitis have been very disappointing, owing apparently to a wrong selection of dosage in the treatment of chronic bone infections. This part of the subject is therefore omitted for the present.

But apart from these we believe the period of healing of many sinuses could be very greatly shortened by systematic irradiation. This statement is intended to include such sinuses as occur in empyema if the remaining cavity is not too large. One of our cases in this group, after having discharged continuously for over two years, closed within two weeks after the first treatment. This closure has been permanent. A large cavity will in all likelihood be uninfluenced, and in such cases we do not recommend treatment.

CYSTITIS

Our treatment of cystitis has been almost entirely limited to cystitis following supra-pubic cystostomy and prostatectomy. In such a case with a foul bladder and urine loaded with pus the improvement, which will occur in one or two weeks, is often very spectacular, and in several cases has been the means of saving life.

In addition to the operated cases, however, great benefit can be secured to the victim of enlarged prostate who has also an infected bladder.

It seems highly probable that some at least of the benefit from treatment of these cases is due to the effect upon the cystitis quite as much as to the effect upon the prostate itself.

A further result in operated cases appears to be a hastening of the healing of the sinus which closes much sooner than in untreated cases. Taken altogether, the benefit accruing to this type of patient is so great in the majority of cases as to justify a much wider use of this form of therapy.

In a former article the method followed in cases of enlarged prostate and cystitis has been given in detail. Here it need only be summarized as follows: A series of treatments which fall midway between the mild stimulating or superficial type of treatment and the more intensive irradiation has been selected and is applied through six portals of entry—three anterior and three posterior. One or two areas are given each day, depending upon the individual's reaction. In a few cases an additional perineal area is necessary, but not in the type of case here being specially considered. The technique employed has been five ma., eight mm. aluminum, ten inch distance, nine inch spark gap, fifteen minutes. Under these conditions there will be no skin reaction and the treatment may safely be repeated in three or four weeks. The results have been excellent, both as regards the cystitis and the prostate.

OTITIS MEDIA

In this disease our experience has been limited to a few cases, but has been decidedly encouraging, so much so that I feel justified in including it among the chronic infections in which beneficial results may be expected. More work is being undertaken along this line at the present in order to establish a more careful control of results.

There seems, however, to be a fairly high degree of uniformity in the improvement noted and the method deserves a wide trial on its merits. The technique followed has been selected as a stimulating one: five ma., three mm. aluminum filter, ten inch distance, eight inch spark gap, five minutes. Both ears have been treated at one sitting, and treatment repeated every two weeks the average number of treatments required is five.

CHRONIC PNEUMONIA

Here, also, we are dealing simply with a chronic infection of a slightly different type and of a somewhat more complex character. But in other re-

spects the analogy is very close. We are dealing with a chronic infection of lung tissue which has resulted in a semi-consolidation which refuses to undergo resolution. Two things are evidently required: (1) Stimulation of the activity of the local cells. (2) Elevation of the general phagocytic power of the body.

These, we believe, can both be supplied by x-ray treatment with the result that the period of convalescence will be materially shortened, and in a number of cases complete resolution obtained, where otherwise a most protracted and uncertain course would result.

There is no intention at this time of presenting case reports on this subject. The actual number of cases treated is not large enough to permit of generalization, but taken together with similar results in old chronic bronchitis, in some cases of bronchiectasis and other chest disabilities, it is sufficient to indicate that there is here a fertile field regarding which little has been written and much remains to be done.

In a similar manner we might discuss another group of diseases which we classify as arthritis and neuritis, but in which a low grade infection plays an important and often a predominating part. Two illustrations only will be taken: (1) *Sacro-iliac Diseases and Sciatica*, (2) *Tic Douloureux*.

Of acutely painful disease of the sacro-iliac region it has been our lot to have to deal with a considerable number. X-ray examinations have been negative, clinical findings negative, no relief obtained from strapping, braces, heat, light, electro-therapy or other physical methods. In many such cases permanent relief has been obtained by x-ray treatment. In those cases in which the pain also involves the sciatic nerve relief has been secured in a sufficient percentage of the cases to justify its use in all such cases which prove to be unresponsive to the ordinary methods employed.

In both these groups the routine employed has included the irradiation of the sacro-iliac joints and also the entire lumbar nerve roots on both sides. This, we believe to be of much more importance than treating the distribution of the nerve itself, which, of course, is also done.

TIC DOULEUX

It is the writer's firm conviction that more help can be afforded sufferers from this terrible malady than is being accomplished, although it is admitted that few permanent cures will be obtained and many failures must be recorded. Some so-called failures have

later proved to be successful and have well illustrated the "delayed" effect which sometimes occurs in x-ray therapy and which only proves that we have been too easily discouraged.

One of our cases receives a treatment once every six weeks to two months, and this keeps him in complete comfort until about the expiration of the next interval; another patient re-

ceives an exposure every three months and has only an occasional spasm of moderate severity. Other cases have been entirely relieved, or so much so that treatment has been discontinued, while there have been sufficient failures to prove that too much need not be expected.

The object of this paper has been attained if attention has been secured

to the exceedingly important role which x-ray therapy may be made to play in these two great groups of every-day diseases in which chronic infections of some sort play the chief part. While the exposition of it is not very scientific the usefulness of the method cannot be doubted, and the practical application is very simple and easily within the reach of all.

Post-Operative Mastoid Treatment with X-Ray*

CHARLES GOOSMANN, M. D.

Cincinnati, Ohio

IT is an old observation that patients with acute mastoiditis sometimes experience relief from pain and moderation of the discharge after the slight exposure to roentgen rays incident to making a few plates.

With this in mind, I have been trying since May 1919, the roentgen ray treatment of mastoid cases which were not healing properly after operation. Altogether, there have been ten cases, all of which had been operated, but still complained of pain or discharge, or both. In all of them the improvement was distinct and rapid, and appeared to impress the otologist very favorably. There must be many such cases in which roentgen ray treatment is indicated as an adjuvant, but is not used because its value is not generally known.

My oldest patient was fifty-one, while the youngest was only four years old. The postoperative interval before roentgen ray treatment was started varied from twenty-five days to five years.

The latter case, however, had a second operation about four weeks before commencing roentgen ray treatment, the otologist claiming some infected cells had been left by the first operator. Excluding this case, the longest interval was two years.

The first case had five treatments, but I have since had equally good results with two to four exposures, each consisting of half of an erythema dose, filtered through three mm. of aluminum.

While the explanation of how roentgen rays benefit these cases may not be very important, I started on the assumption that unhealthy granulations were the chief cause of delayed healing, and it is well known that such tissue is very sensitive to radiation, according to the law of Bergonie and Tribondeau. "Immature cells and cells

in an active state of division are more sensitive to roentgen rays than are cells which have already acquired their fixed adult morphologic or physiologic characters." And Mottram has found that actively dividing cells are about eight times more vulnerable than resting cells, when exposed to radium.

This brings up the question of radium treatment in this type of case. The biologic effect, I feel sure, would be the same, and the radium might be preferable in a youthful patient who is afraid of the larger and noisier apparatus. The only disadvantage is the longer period of application. I had intended to use radium on my four year old patient, but he was so tractable that it was decided to give him the benefit of the quicker treatment.

The first patient in this series had a left mastoid operation and a right suppurative otitis media. Both sides were treated and both responded. Since then I have treated several other middle ear inflammations, but without any permanent improvement. It is possible, however, that selected cases of otitis media may also receive some benefit from roentgen ray treatment.

DISCUSSION

DR. ISAAC GERBER, (*Providence, R. I.*): The remarks of Dr. Goosmann are certainly interesting and point out a way to do some possible good. I have been interested in mastoid work from the diagnostic end for quite a few years and have seen quite a number of cases where there has been a delay in healing following operation. From my observations, and from conversations I have had with otologists, I judge there are, as a rule, two causes for this. One is a mechanical cause due to carelessness in the after-treatment, chiefly overpacking of the wound. That is a surgical fault which occurs in many other cases where the overpacking prevents healing. That is the least common of the two factors. In the great majority of cases delay in healing has been found to be due to the fact that

certain elements, chiefly diploë, are left behind in the mastoid at the time of the original operation. In many cases it was due to the fact that no preliminary x-ray study of the mastoid was made and the surgeon had no definite idea as to the actual anatomic distribution. He just went ahead and did blindly what he thought was a radical mastoid operation. Oftentimes there is a peculiarity in structure of the mastoid, so that collections of diploë are left behind, which could not be seen at operation without preliminary x-ray study. In a number of such cases I have x-rayed the mastoid after a more or less prolonged period of non-healing and found these cells. At the secondary operation the otologist went directly after these cells, cleaned them out and the mastoid healed up.

Aside from this group I think very likely there will be another definite group in which the cause is unhealthy granulation tissue, perhaps the result of a general infection which the patient has had for a long time. In these cases I can see where radiation treatment of some sort might be useful in breaking down unhealthy granulations and in stimulating the phagocytosis of the healthy cells. As a matter of fact, I believe healing there will be the same as that which occurs in an old tuberculous sinus. It is the stimulation of healthy cells that clears up the infection. Under those circumstances I believe there will be a definite place in the future for this postoperative mastoid treatment.

DR. CHARLES GOOSMANN (*Cincinnati, Ohio*) (closing): I have had no experience in the treatment of sinuses left by chronic osteomyelitis, excepting those of tuberculous origin. We have all had favorable results with tuberculous sinuses. Dr. Gerber says the effect is due to stimulation of the healthy tissues. I have always thought the beneficial results were due to a destructive action on the tuberculous granulation tissue.

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

X-Ray and Clinical Findings in Normal Chests of Children Six to Ten Years of Age*

THE National Tuberculosis Association some time ago began a new and important phase of its work in an attempt to increase the quantity and character of research work in problems related to its own field in the United States. For this purpose it appropriated \$20,000.00 and appointed a small committee composed of Dr. Wm. Charles White, Medical Director of the Tuberculosis League of Pittsburgh; Dr. Paul A. Lewis, Director of Laboratories of the Phipps Institute, Philadelphia, and Dr. Allen K. Krause, Director of Kenneth Dows Research Fund, Johns Hopkins Hospital, to expend these funds to the greatest advantage.

This committee decided that the best use of these funds would be in assisting researches already under way that held the greatest promise of increasing the practical knowledge of physicians dealing with tuberculosis. This, they considered, would bring the greatest help to those suffering from tuberculosis and the greatest boon to the public from whom the funds were collected. This plan has been carried out in co-operation with the universities.

One of the researches was an effort to establish the x-ray and clinical findings in the chest of a normal child up to ten years of age. For this problem the National Tuberculosis Association nominated the following groups of roentgenologists and clinicians:

Dr. L. K. Pancoast and Dr. H. R. M. Landis, University of Pennsylvania.

Dr. F. H. Baetjer and Dr. C. R. Austrian, University of Johns Hopkins.

Dr. H. K. Dunham and Dr. K. D. Blackfan, University of Cincinnati.

The signed reports of these physicians are here presented in two sections with the hope that they may promote a discussion which will be fruitful in establishing the truth in these two fields.

SECTION I.

The X-ray and Clinical Findings in the Normal Chest of the Child—Report of the Clinical Division of the Committee on Medical Research of the National Tuberculosis Association.

The value of roentgenography in determining the presence of pulmonary disease has long been recognized. Studies to determine the roentgenograms of various pathological lesions of the

lung have been almost without number, yet much difference of opinion exists in the interpretation of findings, largely because no satisfactory observations have been made establishing the variations that may occur in the normal. To one observer shadows noted are indicative of disease, to another they are not evidence of a pathological process; to one they represent lesions of clinical significance, to another they suggest changes of no moment. The realization of this unsatisfactory state of affairs was widespread, but it remained for the Research Committee of the National Tuberculosis Association seriously to consider it and to set about to correct the shortcomings.

In the spring of 1920 that committee called together the collaborators in this work and instructed them to set about in ways of their own choosing to solve the problem, extended to them a financial grant, and in order that the problem might be a very definite one asked that the immediate study be limited to a consideration of the chests of normal children between the ages of six and ten years. The work was begun promptly and a preliminary report was made at the annual meeting of the Association in May, 1921. The findings at that time were incomplete and because of the then limited observations, no very definite conclusions were drawn. However, the practical need of a solution of the problem was apparent. Study was continued throughout 1921 and the first four months of 1922, and the data independently assembled were jointly discussed to evaluate them. Although each pair of workers carried on its investigations without inter-group consultation, although each approached the subject from a different angle, and when first met held views apparently not altogether in accord, it was agreeable to find that an exchange of conclusions disclosed almost a unanimity of opinion. The findings of these six observers—three clinicians and three roentgenologists—are presented to you for your consideration:

Theoretically, the normal child is one of ideal height, weight and development for his age, without subjective or objective evidences of deformity or of disease and without residual changes due to antecedent pathological processes. Practically, a normal child is one of average height, weight and development for his age, symptom-free and without signs of disease. Each such individual, in more or less relation

to his age, will have been ill more or less often, and as a consequence may be expected to show variations from the ideal, not because of present disease, but as a result of residual changes that persist. An appreciation of these facts makes it apparent that the findings, clinical and roentgenographic, in normal children as we meet them will vary greatly from any fixed standards and still must be considered as variants of normal.

The clinical data dealt with in this report were obtained by careful examination of apparently healthy children between the ages of six and ten years. All children who showed signs of disease were excluded from the series. Individuals from various strata of society, foreign and native born, residents of urban and of rural communities, school children and children residing in institutions, children exposed to tuberculosis and some without a history of such exposure, children with and without a history of previous infectious diseases, all symptom-free, and of an approximately normal height and weight for their ages, were studied. A history of each individual was recorded and in making the examinations of the chest, care was always observed to have the child relaxed and to see that no cramped or unnatural posture was assumed, for, as is well known, faulty position may lead to findings that cause confusion in interpretation. In addition, a tuberculin test was made on every child. The clinical data were then assembled, and after the roentgenologist had interpreted his plate independently, the clinical and roentgenographic findings were correlated.

In all, over five hundred children were thus studied, and as a result some very definite conclusions seem warranted.

As in the adult, so in the child, vocal fremitus is more marked over the right upper chest than over the left.

It is generally stated that the percussion note elicited over the lungs of normal children within the age limits under consideration is fuller, more tympanic, of higher pitch and more resilient than that noted over those of adults, and that frequently the tympanic quality is quite outspoken, especially over the lower lobe of the left lung. Although in general our observations confirmed this view, we have been impressed by the fact that in an appreciable number of such children, the note obtained on percussion over the

*—National Tuberculosis Association Medical Research.

lungs is indistinguishable in quality from that elicited over the lungs of normal adults and that the usual resilience of the note is lacking. These findings in many instances have an analogue in shadows noted in the x-ray films, shadows indicative of increased density along the bronchial tree, similar to those seen in the plates of normal adults. This correlation of the findings on physical examination and on x-ray study is more constantly possible in studies of the upper half of the chest. When minor changes similar to those discovered by x-ray examination of the upper lobes, occur in the bases, they usually escape detection on physical examination. In those instances, in which no shadow is found to explain the deviation of the note from the generally accepted one, it is our belief that the lack of resilient quality may be due to a decreased elasticity of the chest wall.

The so-called tympanic quality of the percussion note over the left base may be increased, decreased or be entirely lacking, depending upon the degree of distention of the stomach or colon, the curvature of the spine, and may likewise vary with the position of the diaphragm or with the posture of the child during the examination. The note over the upper thorax is often the same on the two sides. Kroenig's Isthmus averages 5 to 6.5 cm. in width. The lower margins of the lungs posteriorly are at the level of the tenth or eleventh rib and descend from 1.5 to 3.5 cm. during forced inspiration.

A just detectable diminution of resonance over the apical regions is of no significance unless associated with a modification of the breath sounds in those areas or with other abnormal auscultatory findings.

It is generally accepted that normally in childhood the breath sounds have a harsh, sharp character with expiration longer and better heard than in the normal adult. This so-called puerile breathing is physiological and though it may seem trite, let it be emphasized that this exaggerated vesiculo-bronchial respiratory murmur, especially well heard in the areas overlying the great bronchi (that is, anteriorly at the level of the first interspace and the second rib just lateral from the sternal margins, and posteriorly, particularly on the right side, at the level of the second and fourth spine) is often incorrectly interpreted as evidence of pulmonary disease. An auscultatory finding that has not been pointed out, or at least, has not been emphasized, has come forcibly to our attention in carrying out this study. Just as the full, deep note or higher pitch characteristi-

cally elicited by percussion of the child's chest is often replaced in health by a note more like that produced when one percusses the normal chest of an adult, so, on auscultation of a child's normal lungs, the exaggerated or puerile breath sounds may be lacking, and instead the so-called vesicular respiratory murmur characteristically present in adult life is heard. This finding, regarded by us as a physiological variation, has been noted as early as the age of four years and may perhaps occur in younger children. It is more readily appreciated and more often found than the variation in the percussion note just described. In more than fifty per cent of the children in which this type of breathing was heard, examination with the x-ray gave findings like those obtained by a study of normal adult chests. In fact, the agreement of clinician and roentgenologist was so constant that we have come on the basis of these variations to designate the chest of normal children as of "puerile" or of "adult" type. The essential fact to be stressed is that so-called vesicular respiration is heard with great frequency in normal children, and is to be regarded as a variation of normal and not necessarily as an indication of disease.

These variations and those of the percussion note are more generally found in children with a history of infections of the respiratory tract. No satisfactory explanation for this finding is offered. It may be due in part to altered resilience of the chest wall, a suggestion supported by the fact that in some instances in which it was noted, diminished elasticity of the thoracic wall was apparent on percussion. It may stand in relation to variations of elasticity of the parenchyma of the lung. It may be due to a relative narrowing of the lumen of the bronchial tree. It is hardly to be considered evidence of increased density of respiratory tissue, for, theoretically, at least, that should lead to a modification towards bronchial breathing.

Concerning the whispered voice sounds, little comment needs to be made other than to emphasize their loud transmission often with syllabation over the region of the major bronchi. Auscultation of these sounds over the upper thoracic spine of the children has led to the conclusion that D'Espine's sign as indicative of enlarged tracheo-bronchial lymph nodes is, to say the least, of doubtful value. In twenty-three of the children, this sign was elicited without other signs of a mediastinal mass and without any corroborative evidence on x-ray examination. In three, the sign could not be elicited, al-

though from the x-ray plate it might have been inferred that it should be. Eustace-Smith's sign is so generally present in normal children that it is of little or no practical diagnostic worth. The presence of these two signs, together with impairment of resonance in the intercavicular region is all too frequently made the premises for a diagnosis of tuberculosis of the tracheo-bronchial lymph nodes. This is unwarranted, for, as indicated, these signs are unreliable evidence of a pathological condition, and the determination of a diminution of resonance in the intercavicular region requires such a nicety of technic that even masters of percussion disagree as to the presence or absence of significant findings in this region of the chest.

A year ago, in the preliminary communication to this society, we stressed the importance of the role that antecedent infections might play in the production of areas of increased density within the respiratory tract (bronchial tree, parenchyma of the lungs, etc.) This fact is re-emphasized, for further study has established the importance of it. Not only may recognized or remembered infections of the bronchi and lungs be responsible for alteration in these tissues, but other diseases not ordinarily considered of significance in this regard may be causal of such changes. For example, our observations indicate that after measles, pertussis or tonsillar infections areas of increased density, radiating from the hilum into the bases especially, occur with great frequency. Such lesions generally are not discoverable on physical examination and would be unsuspected but for the use of the x-ray. They are referred to in the clinical part of our joint report in order to point out the need of a careful history as well as examination in all individuals, before proceeding finally to interpret the findings of the roentgenologist. By way of digression, it may be interesting to point out the fact that though measles and pertussis have been known to produce lesions in the upper air passages, involvement of the lower tract has been considered a complication and was thought to occur only when evidence of bronchitis or of broncho-pneumonia were discovered. Our observations indicate that there may be a mild inflammatory process throughout the respiratory passages in a large percentage of the so-called uncomplicated cases of these diseases. This suggestion warrants further study in relation not only to the infections under consideration, but also other infectious diseases. That such shadows, mediastinal and basal, noted in children who

give a history of uncomplicated measles and pertussis, are evidences of healed processes is evidenced by the experience that similar shadows of like origin have remained unchanged and without the development of clinical symptoms in a series of children observed from three to five years. Such changes must be properly evaluated as indices, not of present disease, but of lesions past and healed, not as warrants for the diagnosis of present illness and the institution of treatment, but as scars of infections met and overcome.

Most of the children included in this study were tested with tuberculin—some were given a cutaneous test with old tuberculin (Pirquet), others were tested by the intracutaneous method (Craig).

The foregoing facts have been detailed at some length to establish the major thesis that, clinically, the ideal, normal child is a hypothetical impossibility. Children, apparently healthy, symptom-free and active, show on careful examination many deviations from fixed standards, variations that must be interpreted as within physiological limits; standards of height and weight must be elastic; measures of resonance and of resilience of the chest must not be rigid, and estimates of acoustic phenomena must permit of a range of difference from the ideal. These facts, clinical experience establishes beyond peradventure, and they suggest a corollary, namely, that x-ray examination of the chest of such children may be expected to show comparable deviations from a fixed ideal roentgenogram.

The studies reported, fortified by past experience, warrant the following conclusions:

(1) The data obtained on percussion and auscultation of the lungs of normal children show wide variations from a fixed standard. These variations are usual and are considered to be within normal limits.

(2) Inasmuch as the changes referred to are dependent often upon alterations that persist as the residua of past infections of the respiratory tract, it is obvious that a careful anamnesis, with special reference to all infections, is necessary if diagnostic errors are to be avoided. Even a history carefully taken is often unreliable, as minimal infections are soon forgotten by many, and among the unintelligent classes even more significant indispositions are not readily recalled.

(3) Failure properly to evaluate these deviations from a fixed standard will often lead to the unwarranted diagnosis of disease and to even less justifiable treatment.

(4) With a proper appreciation of the widest variations that the normal may present from the ideal, the informed clinician is better able correctly to understand the findings of the roentgenologist, and each, co-operating with the other is less liable to error.

(5) D'Espine's sign as indicative of enlarged tracheo-bronchial lymph nodes is of little value.

(6) Recognition of and familiarity with the foregoing data is of cardinal and practical importance to every patient, potential and established. Without a proper appreciation of the facts set forth, no intelligent differentiation between a normal and an abnormal respiratory tract can be made.

In brief, to establish the presence or absence of disease, it is imperative that all data—clinical, laboratory and roentgenographic—must be evaluated and correlated and that no one fraction of the evidence be stressed to the exclusion of the others.

(Signed)—C. R. AUSTRIAN

H. R. M. LANDIS

KENNETH D. BLACKFAN

May 6, 1922.

SECTION II.

The X-ray and Clinical Findings in the Normal Chest of the Child—Report of the X-ray Division of the Committee on Medical Research of the National Tuberculosis Association.

It is generally conceded that one of the most important factors in accurate interpretation of the appearance of morbid processes in the roentgenogram of the thorax is a thorough familiarity with the normal and variations therefrom within normal limits. With a full realization of this in view, the National Tuberculosis Association in 1920 appointed a committee comprising three roentgenologists and three internists to make a study of the normal chest of the child between the ages of six and ten years. This group was instructed to work in co-operation and to make a report of their investigations before the Association when their studies were completed and their conclusions reached. The members selected for the committee were Dr. H. Kennon Dunham of Cincinnati, Dr. Frederick H. Baetjer of Baltimore and Dr. Henry K. Pancoast of Philadelphia to act in the capacity of roentgenologists and to work in co-operation with the respective internists in the same cities, Dr. Kenneth Blackfan, Dr. Charles R. Austrian and Dr. H. R. M. Landis. Each group of two was to work independently until a satisfactory number of individuals were

examined, and the entire committee was then to meet and draw their conclusions for presentation. It was to be the duty of the internist in each group by careful clinical study to select as nearly normal children as possible for examination by the roentgenologist. The entire procedure was to be carried out with strict co-operation between the two members of each group.

It was soon realized by the x-ray members of the groups that an attempt to describe a normal chest was practically impossible. Their endeavors soon began to center around the description of a theoretical normal with wide variations that would serve as a basis for the interpretation of abnormal appearances and tend to preclude the possibility of erroneous diagnoses being based upon faulty interpretations of hilum shadows, trunk shadows and linear markings more or less altered in appearance by the frequent respiratory infections of children. They realized that herein had existed the greatest source of error in interpretation, and no doubt the Association had this same thought in mind when the committee was appointed to take up these investigations. Errors in interpretation have been made chiefly in connection with the diagnosis of pulmonary tuberculosis.

It was the consensus of opinion that children are probably more apt to show definite x-ray evidences in the hilum and trunk shadows of simple as well as serious respiratory infections than adults. Practically all children of the ages of those examined have had at one time or another one or more respiratory infections, especially measles and whooping cough, that are likely to produce very apparent changes in the shadows mentioned, and which will remain distinctly visible for a variable period of time. These apparent deviations from the normal are not necessarily abnormal when observed, but may be the harmless results of one or more infections. No doubt such appearances have many times been misinterpreted as evidences of tuberculosis. In the conclusions reached by the committee the attempt has been made to preclude this possibility.

Many of the general observations may not have been included in the conclusions. One of these perhaps worth mentioning is the fact that the heart of the child is found to extend relatively farther to the right than in the adult.

The thoroughness with which the studies were carried out may be in part realized from the number of individuals examined. Over five hundred children were selected from all strata of life, as stated in the clinical report of the committee.

The groups comprising the committee met at the Phipps Institute, Philadelphia, March 3, 1922. Prior to this meeting there were misgivings as to the possibility of an agreement upon any very definite conclusions, but much to the satisfaction of all the members a definite agreement was reached and the conclusions were completed after a few hours careful deliberation.

To assist in a better understanding of the conclusions of the committee, a composite diagram reproduction of several roentgenograms was made. It must be remembered that the three zones like the chest have thickness as well as length and breadth. Thus the zones extend anteriorly and posteriorly from the lung root as well as laterally.

CONCLUSIONS OF THE X-RAY DIVISION OF THE COMMITTEE

The Normal Chest. The normal chest of the child from the roentgenologic standpoint is subject to such wide variations within normal limits as to be beyond the possibility of exact description.

Hilum Shadow. The conglomerate shadow commonly called the hilum shadow, when found lying entirely within the inner third or zone of the lung area can be disregarded, or regarded as normal, except where it is made up of a solid mass of homogeneous shadow giving undoubted evidence that it represents a growth or mediastinal pleurisy.

Calcified Nodes. Calcified nodes at the root of the lung, without evidence of lung disease, are of no significance except as a possible evidence of some healed inflammatory condition, possibly but not necessarily tuberculous. They are a common finding in normal chests.

Density and Thickness of Trunk Shadows. In the normal lung the bronchial trunk shadows are not visible in the extreme apical regions. For convenience of description the remainder of the lung is divided into three vertical zones, extending outward from the lateral border of the spinal shadow to the lateral chest border.

The inner zone contains the root shadows.

The mid-zone contains the trunk shadows, gradually fading out into their final subdivisions.

The peripheral zone contains radiating lines from these, fading off before the periphery is reached.

Where in the mid-zone or peripheral zone these shadows do not disappear in the characteristic fashion described, the appearance may be evidence of a variety of conditions, past or present, of an inflammatory nature or otherwise. It may accompany a tuberculous process, but is not necessarily indicative of tuberculosis.

Improper or Misleading Terms. The use of the terms "peribronchial tuberculosis" and "parenchyma tuberculosis" is not to be recommended in the interpretation of roentgenograms of the chest. Until corroborated by laboratory or clinical findings, the use of the terms "active" and "quiescent" should not be definitely applied to evident lesions demonstrated on plates.

(Signed)—HENRY K. PANCOAST
KENNOR DUNHAM
F. H. BAETJER

May 6, 1922.

The X-Ray Analysis of the Sounds of Speech

A. E. BARCLAY, O. B. E., M. D. and WILLIAM NELSON, O. B. E.
Manchester, England

DURING the war there were a large number of cases of functional aphonia and the re-education in speech of these men presented very considerable difficulty. In the schools for the deaf and dumb charts were in use showing the various positions of the tongue and lips for the formation of the various sounds of speech, but these were not satisfactory as they were based, except in the case of the open sounds, on the personal impressions of the phonetician and others who made the charts. There was obviously room for considerable error, especially in the closed sounds. With a view to helping in this matter it was decided to attempt radiographic work upon the subject, as a result of which a number of experiments were made in order to show up the tongue, palate and pharynx. After a number of experiments it was found that the best method was to make a paste of bismuth carbonate with vaseline, and apply in a line down the middle of the tongue and frenum, with a corresponding line on the soft palate. As a further assistance a fine bismuth powder was insufflated on to the back of the tongue and into the pharynx. After a number of experiments we obtained satisfactory outlines and two subjects, teachers from the Royal

Schools for the Deaf and Dumb, Old Trafford, were examined and three sets of records were made, the subject being instructed by one of us while the other was responsible for the radiography.

A series of eighteen plates was taken in each case and these had to be exposed very rapidly, as the bismuth did not adhere at all satisfactorily and any swallowing displaced it. The whole of the exposures, therefore, were made in a few minutes. A supply of intensifying screen sufficient for the purpose was not available so that the exposures were made on ordinary plates and no special apparatus was employed. A filter was placed against the subject's skin, and another filter of aluminum in front of the tube, and no ill results were recorded from the exposures.

The plates were carefully outlined on the viewing box and each set of three carefully compared; it was found that there was practically no difference in all the three sets of records. The best plate from each of the series was taken and outlined very carefully in ink, and the set obtained in this way was placed in the hands of the artist of the deaf and dumb school, Mr. Owen, who very kindly drew diagrams directly from the plates and at the same time drew

sketches of the front view of the face for the various sounds.

We hoped to obtain a series of plates with the assistance of intensifying screens, which would be suitable for reproduction, but owing to various difficulties we have not done so and the work has been put aside for some years, together with the descriptions which were written out at that time. These we proposed to publish, but unfortunately the whole of the papers relating to the subject were stolen by some person, who probably scattered them abroad when he found out the valueless nature of his haul.

Professor Stopford and others, who saw the work, were anxious that the diagrams should be put in use, and they have not until now been published for the above reason, but we hope that we shall be able to take up the work again and expand it in various directions.

LEGENDS FOR ILLUSTRATIONS

Fig. 1—"ar" as in farm—The lower jaw shows a considerable drop. The tongue lies on the floor of the mouth. The soft palate is in line with the hard palate. The resonance chamber is not in any way restricted. It is open and free and allows of the emission of a deep sonorous and powerful

sound. The opening at the lips corresponds.

Fig. 2—"aw" as in paw—The lower jaw shows a lesser drop than in "ar" but is still considerable. The tongue is drawn back and shows an almost regular arch from tip to root. At its highest point it almost touches the soft palate, which has slightly dropped towards it. The dotted line indicates a hollowing of the upper surface of the tongue from the tip to just behind the highest part of the arch. The lines of the upper and lower teeth are almost parallel and explain the effect of a slight raising of the lower jaw from the position of "ar." The resonance chamber is more forward and restricted in capacity than in "ar." The opening at the lips is round. The cheeks are slightly drawn in and the corners of the lips contracted.

Fig. 3—"oo" as in tooth—A still further modification of the drop of the lower jaw has taken place, bringing the teeth still nearer to a parallel position. The tip of the tongue is drawn back as well as the root, showing an almost perfect arch, which fits exactly at the sides to the line shown by the soft palate, but leaves in the middle a hollowed tongue passage for the current of air. The capacity of the resonance chamber is almost equal to that

of "aw" but less wedge shaped owing to the blunted forward position of the tongue. The lip opening is small and round, showing greater contraction of the lips than in "aw" and still further protrusion.

Fig. 4—"er" as in fern—The drop of the lower jaw is almost identical with that in "aw" but the tongue rises more directly at the root and assumes an even flatter position on its upper surface than in "ar." To attain this position it is held away from the floor of the mouth somewhat. The hollowing at the middle of the tongue lies along the whole of its upper surface. The corners of the lips are very slightly drawn back.

Fig. 5—"ee" as in teeth—The drop of the lower jaw is less than in any other of the vowel sounds. The teeth are seen to be in parallel lines, almost but not quite meeting. The upper surface of the tongue and whole of the roof of the mouth form a narrow parallel air passage. The tongue shows no hollowing. The lips are well drawn back at the corners producing a narrow slit at the opening in correspondence with the form of the air passage.

Fig. 6—"p" as in path, vocal counterpart "b" as in bath—The lips are slightly compressed. The air passage between the tongue and roof of the

mouth is free throughout its length. The stopped breath produces the explosion on the instantaneous opening of the lips.

Fig. 7—"t" as in troop, vocal counterpart "d" as in droop—The lips are open. The tip of the tongue forms the stoppage at a point on the gums of the upper teeth. The release of the stoppage produces the explosion.

Fig. 8—"k" as in kick, vocal counterpart "g" as in gig—The lips are open. The stoppage is formed by the arching back of the root of the tongue, which shows no hollowing, to meet the soft palate. On the release of the stoppage the explosion is affected by the resonance chamber before it reaches the lips.

Fig. 9—"f" as in ferry, vocal counterpart "v" as in very—The upper lip is free. The upper middle front teeth are in gentle contact with the lower lip. The air passage is quite free and the breath is forced between the gently resisting lower lip of the upper front teeth.

Fig. 10—"th" as in thin, vocal counterpart "th" as in thine—The position of the tongue is practically the same as in "t" but the tongue is hollowed and the current of air is forced between the gently resisting tip of the tongue and the upper front teeth.

Fig. 11—"l" as in land—The air passage is closed at the front by the pressure of the tip of the tongue against the upper front gums. The tongue is hollowed. The breath passes between the edges of the sides of the tongue and the cheeks.

Fig. 12—"r" as in round—The air passage at the back is slightly restricted by the dropping of the soft palate towards the sloped roof of the tongue. It finds its outlet between the gently resisting tip of the tongue and the upper front gums. The sides of the tongue close up the passage used in "l." The tongue is slightly hollowed.

Fig. 13—"s" as in sand, vocal counterpart "z" as in zone—The lower jaw is slightly dropped. The tongue lies fairly flat but shows a distinct hollowing from the root almost to the tip where it is brought into gentle contact with gums of the upper teeth. The breath passage is free and hollow until the point of cheek is reached at the tip of the tongue. The lips are free.

Fig. 14—"sh" as in short—The photograph of this sound is extremely interesting. The soft palate and hollowed root of the tongue form a large funnel shaped passage for the start of the current of air. The outlet of the funnel is immediately below the junction of the hard and soft palates. Then the front part of the tongue is flattened,





spreading the breath out through a wide shallow passage, and, as it were, intensifying its force for friction against the gums and teeth and over the wide tip of the tongue.

Fig. 15—"m" as in mine—The air passage through the mouth is closed at the lips. It finds its vent through the nasal passage. The resonance chamber is formed by the hollowing of the tongue and the roof of the mouth, mainly under the hard palate, but the resonant vibration can be felt at the nose.

Fig. 16—"n" as in nine—The air passage is closed by the contact of the tongue all round the upper gums. It finds its vent through the nasal passage.

The resonance chamber is further back than in "m", stopping at the teeth and not affecting the lips. The resonant vibration can be felt at the nose.

Fig. 17—"ng" as in song—Compare this position with "k", with which it is almost but not quite identical. The front and tip of the tongue is much rounded up and the curve of its upper surface shows a truer arch. The reso-

nant chamber is back and nasal. The stoppage occurs at the middle of the soft palate. The resonant vibration is distinctly felt at the nose.

Fig. 18—"wh" as in what—Compare this sound with "oo". The tongue is not hollowed as in "oo". The air passage is between a flattened tongue and straightened palate. The tongue curves less abruptly at the root and is more forward at the tip than "oo". The pursing at lips is identical with "oo".



EDITORIAL

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Signs of the Times

IN the *Journal-Lancet*, June issue, appears "A Symposium on the Medical Profession and Its Relation to the Press and Public." That symposium is composed of a thesis on the medical phase of the situation by a practicing physician, a second by one of the editors of *The Minneapolis Journal* on the obligation of the press as a quasi-public servant to give the people medical facts and news because of their social importance, and a third by a minister of the gospel on the moral duty of both the medical profession and the press to teach and preach the science of correct living.

Discussion of these papers, which were read at a meeting of the Hennepin County Medical Society, includes comments by newspaper men, lawyers, and others.

Though it is not definitely so stated, the conclusion is inevitable that the purpose of the meeting in question was to afford the medical profession in that community intimate contact with the views and opinions of at least a part of the public on the various phases of the medical problem. Obviously, this was done in the belief that it might prove the beginning of some plan which would more nearly discharge the social obligation of the medical profession as the guardian of the life and health of the public—a question very prominent in medical minds everywhere at the moment.

Such an effort is certainly commendable. The only regret possible is that none of the principal speakers or discussants offered any concrete suggestion beyond the proposition that there is great need for, and the door is wide open to, proper publicity concerning the achievements of the medical profession. Apparently no thought was given to the larger questions this sort of an undertaking involves. Either no one present grasped the idea that it is necessary to predicate an effective educational campaign of publicity on the broad fundamentals supporting the whole scientific structure in its application to medical science, or if he did recognize what should be an obvious fact, he did not go behind the scenes deeply enough to convey the impression that he had given serious thought to its complicated factors.

In all fairness, however, it should be noted that Mr. Chamberlain, of *The Minneapolis Journal*, rather vaguely hinted that it is not possible to accomplish a more universal understanding of the medical profession's job until the profession itself, organizationally and individually, recognizes the social aspects of scientific research, and the right of the public to quick access to the findings and achievements of

scientific workers. Perhaps he may be pardoned for not coming out plump with a statement that the medical profession is itself responsible for the condition which it apparently seeks to cure.

There is, of course, no question about either the power or the value of the right kind of publicity through the columns of the daily press in matters pertaining to the scientific or medical side of the public health. That the newspapers are waiting with open arms for authentic scientific data written in understandable English, is proof positive that opportunity exists whereby the medical profession can, if it will, project itself into individual, community, and national life with sufficient force to accomplish whatever it earnestly desires so long as it shows proper forethought and respect for the public welfare. But it must be borne in mind that effective and intelligent publicity in the interest of the public health presupposes a large constructive purpose upon which to build public good will.

It is not purposed to raise any issue concerning either the ideals or attainments of the medical profession. They are traditional and conceded to be of the highest sort. But it can hardly be denied by any person who takes the trouble to follow current medical literature that there is a prevailing spirit of uncertainty about the future of medical science, particularly viewed in the preventive or social aspect, with very little corresponding effort to come at a comprehensive understanding of the ticklish problems involved. Yet this is the only way in which the medical profession can ever hope to achieve that condition of public confidence and respect for which it is obviously groping.

The point of this observation is that the public itself does not seriously entertain the notion that socialized medicine as it is commonly contemplated, will achieve the end sought. Rather, the best which can be said of it is that socialized medicine is the power invoked by the public to compel the medical profession to find itself and assume the responsibilities which rightfully belong to its sphere of activities as a factor in the social organism.

These are facts it is not easy to refute. Having examined them long and thoughtfully, these are the facts which drove the *Journal of Radiology* to the conclusion months ago that if the medical profession really and conscientiously desired to discharge its full duty to the public, both as individuals and as a social unit, it would be obliged to conceive and put into practice some constructive policy broad enough in its scope to include all humanity, and grounded deeply enough in those absolute fundamentals of every day human existence to command the respect of all thinking men at least.

Such an abstraction, it must be realized, is utterly valueless as a social proposition unless it is carried across into concrete application. It may be trite, but it is worthy of repetition, that without practical application, neither the medical profession nor the public can ever receive any tangible benefit from ideals, no matter how graciously acknowledged to hold the possible solution of the social dilemma.

At first thought, all this may seem far removed from the question of publicity—the thing specifically under discussion. But since the only kind of publicity that can be considered seriously, or tolerated at all in such a vital subject, must always be educative in character, the point made

is well founded; in fact, is indisputable. And no man will accept the responsibility of putting such an idea into function until certain assurances are given that professional machinery has been set in motion for the purpose of providing accurate scientific facts. It has been said no honorable man will accept this responsibility. The advertising scalawag and publicity hypochondriac, with neither conscience nor scruples, have no place in this desideratum.

Perhaps it will clarify what may otherwise appear an ambiguous statement, to say that theories espoused by any one man (no matter how amply proven to his personal satisfaction in a field of observation whose limitations are prescribed by human possibilities and the requirements of professional activity) are not, and can never be, sufficiently absolute and inclusive to encompass the whole problem of the public life and health. There are essentially many factors to which one mind cannot give detailed consideration. Each of these factors must be measured in its relation to all the others, and not as the sole conundrum whose solution will unleash the *deus ex machina* and guarantee the perfect superman, mentally, physically and morally.

Suited acts to beliefs, during the past year the Journal has carried a series of editorial discussions expounding the purposes of a research program instituted by The Radiological Society of North America. Suggestions have been, and are constantly being, solicited from the faculties of all the higher institutions of learning, medical practitioners, and scientific and social workers.

While the survey in question has been specifically directed to the science of Radiology, yet it has elicited a method of procedure which can be applied with equal effect to the medical profession as a whole. That method of procedure is the co-ordination and correlation of all scientific research in all matters affecting the public health. It is contended that the medical profession should voluntarily assume the initiative in this important undertaking because it is *per se* responsible for the health of the nation as well as the individual.

Consequently, it is with a good deal of satisfaction that here and there appears proof of the fact that the idea is taking root. For instance, The Social Hygiene Bulletin for June, 1922, contains an announcement that the "National Research Council Sponsors Fundamental Research in Sex Problems." The opening paragraph reads:

"The need for scientific research in the field of sex has long been recognized by scientific workers, physicians, and educators. With the co-operation of the American Social Hygiene Association and the Bureau of Social Hygiene, Earl F. Zinn was delegated to investigate the possibilities of a research program in this field. The matter was placed before the National Research Council, with the result that the program has been taken over by the Council."

A committee has been appointed, whose purposes "are to determine the status of scientific knowledge in this field; to determine what research is now in progress in this and other countries; to secure from scientific workers, physicians, and educators, statements of the major problems on which more data are needed; and to make a thorough survey of research facilities, including trained workers who are interested in some phase or phases of this topic.

"It is the committee's plan to aid scientific workers in their investigation in this field. An appropriation of \$25,000 has been secured to carry on this work after July 1st, 1922. With this money the committee will subsidize as many

researches as possible.

"Concerning the nature of the research, the committee emphasizes the fact that it is interested in fundamental scientific studies and is endeavoring to lay the foundation for a prolonged scientific inquiry. When sound physiological bases are established, the work will be extended to include human problems.

"Eventually this work will include the relationships of the subject to the following sciences: general biology, physiology, psychology, psychopathology, anthropology, ethnology, sociology."

It is also a privilege to quote excerpts from two letters just received. The first is from Abraham Myerson, M. D., Assistant Professor of Neurology at Tufts Medical School, Boston:

"Thank you very much for sending me your magazine and the outline of your projected researches. I must confess that I am lost in admiration at your plans and the spirit and energy with which they are to be prosecuted. It is refreshing to see at least one branch of medicine that is utilizing all its resources and all the resources of the allied sciences in the effort to discover phenomena that will be of benefit to mankind. Your branch of the sphere of medicine is so rich in its possibilities as well as in accomplishment that those of us who deal with less concrete matter are a bit envious of you. I confess that such a spirit is still lacking in neurology and psychiatry."

The second is from Dr. C. H. Rieber, Professor of Philosophy at the University of California:

"It has been on my mind for some time to tell you how much I enjoyed and appreciated an editorial in The Journal of Radiology for February on social medicine. It is a little masterpiece in logic—your argument is irrefutable."

Numerous others of similar vein might be quoted. But it is believed these are sufficient to indicate that the plan proposed appears both practical and feasible to men with vastly different modes of thought, located at points so far removed from the editorial sanctum of the Journal as to be uninfluenced by that sphere of peculiar personal suasion reported to be indigenous to the community in which an editor lives.

The members of the Radiological Society will find in these visible mutations of medical opinion whatever of mental stimuli they may need for the aggressive continuation of the work they have so nobly begun.

Radiology, as a diagnostic and therapeutic aid in the practice of medicine, holds so many latent possibilities and has already attained such eminence by actual accomplishment, that no opportunity should be lost to establish that science on a secure scientific footing.

In this connection publicity should be looked upon as the effect and not the cause. When viewed in that light if the profession's efforts and attainments are welded together by the co-ordination and correlation of all scientific endeavor, proper publicity will follow with certainty and precision and in turn become the medium through which a cohesive spirit of confidence in the profession will be achieved and a thorough appreciation of its value established beyond dispute.

The Industrial Physician

READING the following statement made by The New York Conference Board of Physicians in Industry as supplemented by the National Conference Board, the thought

occurs whether it is not a fact that much of the knowledge and special skill indicated as peculiarly necessary for the industrial physician and surgeon is also highly important for the physician or surgeon in general practice.

The New York Conference Board said:

"The physician in industry is one who applies the principles of modern medicine and surgery to the industrial worker, sick or well, supplementing the remedial agencies of medicine by the sound application of hygiene, sanitation and accident prevention, and who, in addition, has an adequate and co-operative appreciation of the social, economic and administrative problems and responsibilities of industry in its relation to society."

And the National Conference Board added:

"It was felt that in order to avoid a complicated statement it would be better to include in a definition only the broad fundamental principles upon which the work of the physician in industry is based, leaving to subsequent elaboration the finer details. It was pointed out that the definition adopted should emphasize both the medical attainments and the industrial requirements of the physician engaged in this work in order to make his duties clear both to the medical profession and to industrial management."

"It is assumed that the physician engaged in industrial work is well grounded in the fundamentals of medicine and surgery. He is, first of all, a physician. It is obvious, however, that this alone, while equipping him for satisfactory service in private practice, does not meet fully the requirements of industrial work. In his industrial experience he has of necessity to deal with questions of sanitation, hygiene and accident prevention as applied to large numbers of people working in comparatively close association."

"Only by special knowledge of the work in hand will the physician be able satisfactorily to discharge his duties. His knowledge of plant processes together with the physical examination of applicants for employment and of workers already engaged will enable him by judicious placement to reduce materially the accident and morbidity hazard and rate."

"It must be realized that many of the qualifications for successful medical work in industry are of a non-medical nature, and call for a knowledge of the laws of social and industrial economics and of the administrative problems which arise in the conduct of an industrial medical department. The physician in industry must have a clear conception of the responsibilities of the industry to its workers and through them collectively to the community. On the other hand, he should recognize clearly the duties of workers to the industry in which they are engaged."

"It is hoped that this definition will tend to remove misconceptions as to the work of the physician in industry and establish his position and his work upon a basis satisfactory alike to the physician and to the industrial organization."

Surely the general physician or surgeon, coming in contact with patients engaged in all lines of endeavor instead of one particular industrial occupation, has greater need for precise knowledge with respect to social requirements than has the so-called industrial physician.

This is especially true because the general practitioner is in a very real sense a disinterested adviser, and carries a

greater responsibility to the community, state and nation by reason of that fact.

This thought is not interjected for the purpose of impugning the motives of the industrial physician. In the inherent nature of the case, however, the industrial physician is influenced to some extent by the fact that he is essentially a protagonist of the industry or concern he represents and by the degree of that influence no matter how unwitting it is, his social conception of medicine fluctuates.

This is demonstrated by the fact that the National Council expresses the opinion that while medical training is sufficient for the general practitioner it is far from sufficient for the industrial physician. Viewed in the sense of social duty it is somewhat difficult to thus differentiate between the obligation of two physicians simply because one collects his stipend from the public directly and the other indirectly.

For these and other reasons it would seem that the National Conference Board has taken a far-reaching step toward impressing on the whole profession a definite notion of the social side of medical practice.

The Apparatus Problem

ONE of the immensely practical benefits which will accrue to practitioners of radiology, the result of such a research program as that undertaken by the Radiological Society, will be a better knowledge of methods used by individual manufacturers of apparatus for the application of radiant energy in its various forms.

Several of the large manufacturers of apparatus have already requested that the Radiological Society appoint an examining board, composed of one or more thoroughly reputable and disinterested physicists, to whom they can submit complete data concerning every piece of apparatus they now, or may hereafter, have on the market. The name of Dr. William Duane of Harvard has been suggested as indicating the caliber of man the manufacturers have in mind.

It goes without saying that the members of the Research Committee—and in this respect they believe they voice the best interests of radiologists everywhere, whether members of the Radiological Society, of some other similar organization, or of none at all—appreciate the community of spirit evidenced by those manufacturers seeking the establishment of this sort of disinterested scientific control over the commercial or mechanical side of the question.

Such an arrangement will do no harm to the honorable manufacturer—indeed, it will be a potent aid in stabilizing the future of the science—for it will rid the field of wilful misrepresentation, and enthusiastic but certain ignorance, and will assure the person conscientiously trying to discover further phenomena the opportunity to present his findings for review before a sympathetic, intelligent and unimpeachable board.

The value of all this to the individual radiologist is apparent. Such an arrangement will overcome the confusion existing in the minds of radiologists generally with respect to representations made by manufacturers—in short, it will put every radiologist sufficiently interested in the subject to follow the proceedings and findings of the board, in position to buy intelligently the apparatus and equipment best suited to his particular needs and practice, without spending weeks away from home viewing other installations at a heavy financial expense in loss of practice, railroad fare, hotel bills and the like.

Thank You

THE following is an excerpt from an editorial appearing in the May issue of *Colorado Medicine*: "The Radiological Society of North America, an organization which has advanced with rapid strides in the last four years, is

launching a somewhat colossal undertaking in the way of research work in radiology. The continued discoveries of new uses for the x-ray and new methods of application, as well as new and more powerful apparatus, are the result of research work carried on largely for the love of it by individuals, many of whom have gained outstanding fame in the field of radiology. These efforts have been necessarily more or less spasmodic, the character of the work undertaken by different individuals has depended on their interest in some particular phase, and there has been little attempt at co-ordination of effort. The undertaking now in hand is to raise a large 'research endowment fund' for systematic initiation and supervision of research work in radiology. The plan does not contemplate the establishment of one large research laboratory in a large center, but is to provide for carrying on work through channels already in existence, among which are x-ray laboratories of most of the large universities and many privately owned ones. Harvard, Wisconsin, Illinois, Michigan, Iowa, Loyola, Cincinnati, Leland Stanford, Kansas, California, Washington, Rush, and many others have already signified their willingness to co-operate. Much of the money is to be raised by subscriptions of radiologists who are members of the society before any attempt is made to enlist outside support. This would seem to evidence the sincerity and enthusiasm of the members who are backing the plan."

Features of the St. Louis Meeting

THE attendance at the St. Louis meeting was larger than is usual at the summer meetings.

It is highly fitting that public acknowledgment be made of the excellent service rendered by the local committee on arrangements, of which Dr. Edwin C. Ernst was chairman. No detail was left unarranged. The committee deserves the highest commendation for the service rendered.

On the scientific program the greatest tribute was paid to Maude E. Slye, Ph. D., when she read her paper entitled, "The Inheritability of Spontaneous Cancer in Mice and its Application to Man." This paper represented eighteen years of research work. The material was so ably presented and so abundantly proven that no one can disprove the facts laid down. The audience was so impressed with the value of this material that the applause following its presentation was long and enthusiastic, and when the author failed to acknowledge this ovation the audience arose to its feet as a further expression of appreciation.

The paper presented by Dr. Leo Loeb of Washington University, St. Louis, on "Cancer from the Standpoint of Etiology and Pathology," was very helpful and very important to radiologists.

The paper given by A. C. Ivy, Ph. D., on "Studies on the Effect of X-rays on Glandular Activity," was one of very great importance to those practicing x-ray therapy. It is certainly to be hoped the doctor will go on with this work and present further material along this line at a later meeting.

The paper of Dr. George E. Pfahler on "Radiotherapy of Carcinoma of the Larynx with Special Reference to Needling Through the Thyroid Membrane," was a timely one, and showed the careful work which this man does in the treatment of malignancy.

Considerable discussion was provoked by the paper entitled "The Effects of Heavy Radiation on the Pleura and Lungs," given by Dr. Tyler. This is a subject of extreme importance to those using the x-ray in therapy. The results of further investigation along this line will be presented at a later meeting.

The banquet on Saturday evening was informal and elicited many complimentary comments.

The commercial exhibit was unusually interesting, was well arranged and many expressions of satisfaction were tendered by the commercial men.

John F. Shearer, Ph. D.

OSLER once said that pneumonia was the old man's friend. His demise proved the truth of his statement. Although pneumonia, followed by heart complications, caused the death of our beloved brother and co-worker, John F. Shearer, the adage hardly applies in his case, for he was just in the prime of life—his work only half done.

It will be recalled that Professor Shearer was very active in the American Roentgen Ray Society. In fact, he served as chairman of the Committee on Safety. Although the report of this committee is as yet unpublished, it was completed shortly prior to his death and will remain as a tribute to his untiring industry and far sighted scientific ability.



JOHN F. SHEARER

When physicists were needed for military service in the recent war, Professor Shearer volunteered and was made Chief Technical Consultant to the X-ray Division, American Expeditionary Forces. His services in France were of untold value to the American army.

His position as Professor of Physics at Cornell University gave him an opportunity to carry out much research work in the field of x-rays. His last work was the perfection of a bedside unit, which is proving highly satisfactory. He co-operated with Dr. W. D. Coolidge in perfecting the portable army unit, which proved so valuable in the recent war and which was responsible for the statement made by many that the X-ray Division of the American Expeditionary Forces was the best equipped of any force in the field.

May 16, 1922, closed the physical life of Professor Shearer. But he will long live through the results of his achievements and render service to science and humanity.

Scientific Progress

TWO very important features appear in this issue of the Journal:

1. The X-ray Analysis of the Sounds of Speech by A. E. Barclay, O. B. C., M. D., and William Nelson, O. B. E., of Manchester, England. This is in the nature of a preliminary report of a very interesting study, hitherto unpublished.

2. Preliminary Report of Joint Committee of Clinicians and Radiologists appointed by the Medical Research Committee of The National Tuberculosis Association to investigate normal chests of children from six to ten years of age. This committee is composed of H. K. Pancoast, M. D., and H. R. M. Landis, M. D., of the University of Pennsylvania; F. H. Baetjer, M. D., and C. R. Austrian, M. D., of Johns Hopkins University; and H. K. Dunham, M. D., and K. D. Blackfan, M. D., of the University of Cincinnati.

The Journal feels very greatly honored in being accorded the privilege of publishing contributions to scientific progress by such eminent men.

The New England Roentgen Ray Society

THE New England Roentgen Ray Society at a meeting held at the Harvard Club, Boston, on June 2nd, elected the following officers for the years 1922 and 1923: President, Ariel W. George, M. D., Boston; Vice President, Ernest L. Davis, M. D., Springfield; Secretary-Treasurer, Adelbert S. Merrill, M. D., Boston; Executive Committee, Alexander S. McMillan, M. D., Boston, chairman; Isaac Gerber, M. D., Providence; Arthur Heublein, M. D., Hartford.

American Registry of Radiological Technician

HISTORY

THE registry is the result of a long and careful study. It was found that there was a great need for the registration and control of radiological technicians. Due to the lack of encouragement by the radiologists, no organization for this class of technicians has received widespread support. The American Association of Radiological Technicians formed the nucleus for a larger and highly ethical body of workers. But too often the technician was left in isolation or thrown on his own resources, so that he became in a way a competitor and not a medical assistant. To raise the ideals of this class of medical technicians, to recognize the value or worth of their service, and in the end to prevent frauds and deceptions on the public, are the chief reasons for the establishment of this registry.

For two years a committee appointed by The Radiological Society of North America investigated the need of a Board to register technicians. From the British Medical Society, the Canadian Radiological Society, leading American Radiologists, prominent women in the nursing vocation, and worth while technicians, advice was sought and obtained. In the main, The Radiological Society of North America has been the chief sponsor of the movement. The American Roentgen Ray Society, through Dr. E. H. Skinner and others, has encouraged the movement. As a result, it is expected that the Board now created will form the basis for a permanent registry to encourage, to control the radiological technicians. As time goes on the different states and cities may pass laws establishing just the sort of thing we have now done, but in the meanwhile such action is largely in our hands and may be directed in wise channels.

The effect of the creating of such a registry has been and will be far reaching. Commercial houses manufacturing and selling x-ray equipment have replied endorsing the plan,

and admit the principle of keeping ethical by working with radiologists instead of impostors. The Board of Health of New York City has already added to the Sanitary Code laws requiring technicians to register. They have advised with and recognized the representatives of the Society. It is their aim to issue permits only to medical radiologists.

The future work of the Committee on Relationship between Radiologists and Technicians will be to foster the registry, and to carry on a campaign in every state to bring about through the legislature effective sanitary codes. The medical practice acts must be so defined that it will be clearly set forth that the examination or treatment of patients for disease will mean the practice of medicine. All x-ray laboratories will be registered and under the supervision of a medical radiologist.

PERSONNEL

President. Dr. Edward W. Rowe, Lincoln, Nebraska
Secretary. Dr. Byron C. Darling, New York City
Examiner. Mr. Ed C. Jerman, Chicago, Illinois
Executive Secretary. . . Mr. H. S. Tyler, Omaha, Nebraska
All communications should be addressed to Mr. H. S. Tyler, Omaha, Nebraska, Arthur Building.

At present Dr. E. H. Skinner of Kansas City represents unofficially The American Roentgen Society. It is hoped that his selection at their next annual meeting will be made permanent. A place is open to the Canadian Radiological Society. Dr. L. K. Poyntz has aided materially. Action for appointment to the Board is expected as this goes to print. Correspondence is now going on with the American Radium Society, offering the services of the Board for the registration of radium technicians. It is hoped also that a representative from the American Medical Association or the American College of Surgeons may be secured, to gain some recognition and guidance from those influential organizations.

Since the technicians are a necessary adjunct to our work, since they represent workers in a highly technical field, it is only right and proper that we should give them recognition and help. Our interests are mutual—appearance of competition must be removed, otherwise this good feeling can not exist.

Every radiologist is asked to inform himself thoroughly on the objects of the Board. Also, he is urged to see that his technicians at once avail themselves of this opportunity to obtain a certificate of registry from the Board, which will recognize and encourage only high grade technicians.

EDWARD W. ROWE, M. D.

President, Broad American Registry of Radiological Technicians.

RULES AND REGULATIONS

(Adopted and Approved by the Executive Committee)

ARTICLE I.

The Board

Section 1. A Board of SIX shall be appointed, each member to serve for three years. There shall be two members of The Radiological Society of North America, one member of The American Roentgen Ray Society, one member of The Canadian Radiological Society, one physician and surgeon recommended by The American Medical Association or American College of Physicians and Surgeons, and one representative of The American Association of Radiological Technicians.

Section 2. Duties of the Board. The Board shall pass on the acceptability of candidates seeking certification as to their ability to practice as assistants to any reputable physicians or surgeons; it shall arrange for the examination of acceptable candidates; it shall seek to effect the regula-

tion of all technicians not working under recognized medical supervision, by means of the adoption of proper State and City Sanitary Codes and amendments to the Medical Practice Acts of the States throughout the United States; it shall serve as a source of information as to training schools for x-ray technicians.

Section 3. The Board shall have two regular meetings a year, preferably at the time of the annual and semi-annual meetings of The Radiological Society of North America. At the Spring meeting one radiologist (or roentgenologist) shall be designated as Chairman to serve for one year; and one radiologist (or roentgenologist) shall be designated as Examiner to serve for one year.

Section 4. A salaried Executive Secretary shall be chosen by the Board to carry out the details of the work and act as business manager.

Section 5. These rules and regulations may be revised or amended by the Board at any regularly called meeting.

ARTICLE II.

Registration of Technicians

Technicians whose names are placed on the records of the Board shall be classed as "apprentice technicians" and "radiological technicians." The term "apprentice technician" shall apply to all those who have completed a probationary training period of three months. No certificate will be issued and no fee charged to this class of technicians. An apprentice technician and others who have met all the requirements and successfully passed the examination of the Board shall be designated as "radiological technicians."

ARTICLE III.

Certification of X-ray Technicians

Section 1. Qualification of candidates. Applicants shall be twenty-one years old, male or female. They shall have the equivalent of a two years' high school education and that of a trained nurse. They shall have served as x-ray technicians at least two years under direct medical supervision, counting their bona fide training period.

Definitions: "Equivalent of a two years' high school education"—a student from a private preparatory or other school covering two years of a high school curriculum; or others who have supplemented their knowledge by courses at evening school or by private tutorage of a like school grade.

"Trained nurse"—graduate of a recognized school.

"Equivalent of a trained nurse"—a technician, male or female, who has served at least two years under medical supervision.

Section 2. Application for examination. All applicants shall furnish the following information: Age, education, experience in detail, chronologically arranged; three medical men as references, preferably radiologists; physical description—height, weight, and photograph.

All applicants for examination shall agree to work at all times only under direct medical supervision and under no circumstances to give out written or oral diagnoses or work independently, whether in a private, hospital, or institutional laboratory.

Applications shall be filed with the Executive Secretary of the Board together with a fee of \$10.

References shall be investigated by the Board to determine moral character, training, ability, and other qualifications of candidate.

Section 3. Examination. The Board shall designate some radiologist of recognized ability in the district nearest the applicant, to conduct the examination and report to the Board.

Candidates who have given evidence of satisfactory qualifications and have paid the fee of \$10 shall be notified by the Board of the time and place of the examination.

The Examination shall consist of two parts: (a) practical demonstration of ability, (b) written examination. The questions and subjects covered shall be determined by a member of the Board designated as Examiner and submitted to the Chairman of the Board for approval.

The written examination shall cover (1) Anatomy; (2) Physics—theory; (3) Technique—x-ray room and dark room service.

The practical demonstration shall cover (1) Physics—practical demonstration of machinery; (2) Technique—demonstration by films of specified subjects, and developing.

Questions for the written examination and the subjects for the practical demonstration to be sent under seal to the radiologist appointed to conduct the examination.

Results of the examination, both written and practical, shall be sent to the Examiner for the Board under seal.

No limit is placed upon the number of times a candidate may apply for re-examination, except that re-application may not be made for three months after failure to pass an examination.

Section 4. Certificates. A certificate shall be issued to all candidates who have passed the examination with a grade of not less than sixty per cent. This certificate shall be good for one year only from date of issue; it shall be renewed upon the payment of \$1.00 yearly.

A certificate may be revoked at any time for cause, at the discretion of the Board.

A technician whose certificate for sufficient reasons has been revoked may not be admitted to examination for a period of six months after receipt of re-application, during which time his or her conduct shall be subject to investigation by the Board.

ARTICLE IV.

Further Control of Technicians

This Board shall endeavor to secure the co-operation of State and City Health Officials to further regulate and control technicians by effecting changes in the sanitary codes and revision of medical practice acts throughout the United States to the extent that it shall be illegal for any technician to carry on x-ray work other than under direct medical or dental supervision. It shall further seek to secure the co-operation of National, State, and County Medical Societies.

ARTICLE V.

Registration of Training Schools

Any radiologist (or roentgenologist) who offers a course of training for x-ray technicians in his private office, or any school or institution where such courses are given, may be investigated by the Board. Upon receiving evidence of satisfactory standards, they shall be placed upon a list of such schools and radiologists (or roentgenologists) for distribution to those qualified and seeking information of the Board.

ARTICLE VI.

Reciprocation and Registration

If in the judgment of the Board, like standards of qualifications and examination of x-ray technicians prevail, this Board may recognize the registration of other radiological societies or associations and issue a certificate to an applicant on payment of the regular fee of \$10 for certification and yearly re-registration fee of \$1.00.

APPLICATION FOR REGISTRY

Date.....

Name in Full....., Age.....

(LAST NAME) (MIDDLE NAME) (FIRST NAME)

Address....., Height....., Weight.....

Education: General—High School.....

No. Years..... Date Graduated.....

Private School.....

No. Years..... Date Graduated.....

College.....

No. Years..... Degree.....

Special—Nursing; Institution.....

No. Years..... Registered.....

Electrical, Secretarial, or Other.....

Experience: Nursing.....

Secretarial or Other.....

X-ray experience in detail, chronologically arranged. (If this space is not sufficient, use separate sheet and attach.)

References—Three Medical Men, Preferably Radiologists—(Names and Addresses)


1.....

2.....

3.....

I,, hereby agree to work at *all times* under direct medical supervision, and under no circumstances to give out written or oral diagnoses or work independently, whether in any private, hospital or institutional laboratory.

(Signed).....

 N. B.—Print legibly or typewrite information when filling out this blank.

Enclose a photograph taken within six months of application.

NOTICE TO APPLICANTS

(Please read carefully all information)

Technicians whose names are placed on the records of the Board shall be classed as "apprentice technicians" and "radiological technicians." The term "apprentice technician" shall apply to all those who have completed a probationary training period of three months and who wish to signify their desire of becoming registered with the Board when qualified. No certificate will be issued and no fee charged to this class of technician. An apprentice technician and others who have met all the requirements and successfully passed the examination of the Board shall be designated as "radiological technicians." For information regarding requirements for examination, etc., address the Executive Secretary of the Board.

An application for registration as "radiological technician" must be accompanied by a fee of \$10 (check or money order, payable to the American Registry of Radiological Technicians).

Qualification of candidates for registration as Radiological Technicians. Applicants must be twenty-one years old or over; they must have the equivalent of a two years' high school education and that of a trained nurse. They must have served as x-ray technicians at least two years under direct medical supervision, counting their training period. (A technician who has at least two years' experience will be considered to have training equivalent to that of a trained nurse).

Candidates who have given evidence of satisfactory qualifications and have paid the fee of \$10 will be notified by the Board of the time and place of the examination.

The examination will consist of two parts (a) practical demonstration of ability, (b) written examination. For

further particulars apply to the Executive Secretary of the Board.

The written examination will cover (1) Anatomy; (2) Physics—theory; (3) Technique—x-ray room and dark room service.

The practical demonstration will cover (1) Physics—practical demonstration of machinery; (2) Technique—demonstration by films of specified subjects, and developing.

No limit is placed upon the number of times a candidate may apply for re-examination, except that re-application may not be made for three months after failure to pass examination.

A certificate will be issued to all candidates who have successfully passed the examination of the Board. This certificate shall be good for one year only from date of issue; it may be renewed upon the payment of \$1.00 yearly.

A certificate may be revoked at any time for cause.

A technician whose certificate, for sufficient reasons, has been revoked may not be admitted to examination for a period of six months after receipt of re-application, during which time his or her conduct shall be subject to investigation by the Board.

The United States Army Manual is recommended as a text book covering the technical work, 1918 edition, Paul B. Hoeber, publisher, 67 East 59th St., New York City.

Address communications to

MR. H. S. TYLER, Executive Secretary,

American Registry of Radiological Technicians,

305 Arthur Bldg., Omaha, Nebraska.

Max Reichmann, M. D.

MAX REICHMANN was born in Prague, Austria, November 19, 1864. He was educated in the schools and University of Prague, graduating in 1892. At one time he was a student of and associated with Albert Schoenberg, whose memorial and biography he prepared and presented to the German Medical Society in the fall of 1921.

In 1895 he married Sophie Beck and they had two children, Olga and Margaret. The mother died in 1911 and later he was married a second time to Johanna Stein, who with his two children survive him.

In 1895 also he was licensed to practice medicine in Illinois. He was a member of the Chicago Medical Society, Illinois State Medical Society, the Berliner Roentgen Gesell., the Muenschener Roentgen Gesell., and the Prague Roentgen Gesell. He was a frequent contributor to the Muenschener

medizinische Wochenschrift, the Berliner medizinische Wochenschrift, Fortschritte der Roentgenstrahlen and other German medical publications. He presented a paper upon Fuerstenau's Tiefenmesser before the Chicago Medical Society some years ago.

During his life in Chicago he took an active part in the affairs of the German organizations there, serving as president and secretary of the German Medical Society.

He was at one time roentgenologist to the Alexian Brothers and to the Augustana Hospitals. At the time of his demise he was roentgenologist to the Englewood Hospital of Chicago.

He died in the fifty-sixth year of his life of carcinoma of the rectum. To Dr. Reichmann belonged the distinction of being the first x-ray practitioner in the city of Chicago.



DEPARTMENT of TECHNIQUE

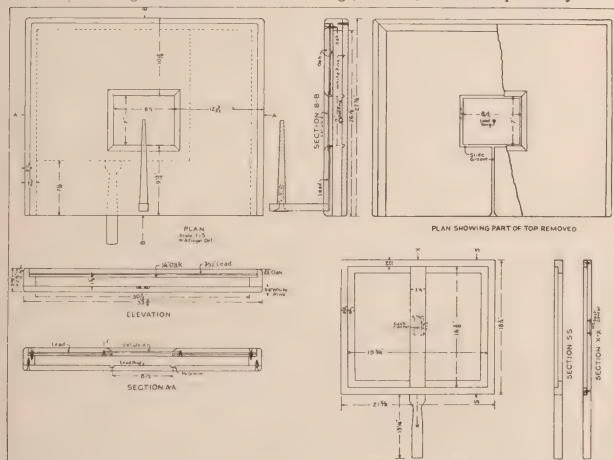
A Table Used for Making Serial Radiographs of the Pyloric Region of the Stomach

DALTON RICHARDSON, M. D.

Austin, Texas

THE sketches herewith show the measurements for a table which I have devised for making four exposures of the pyloric region of the stomach on

a single fourteen by seventeen plate or film. This device has the advantage of economy and convenience. The drawings, I think, are self-explanatory.



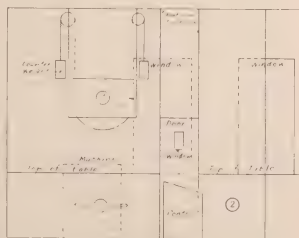
Another Deep Therapy Plan

BENJAMIN W. BAYLESS, M D

Louisville, Kentucky

THE accompanying diagram gives the arrangement of the deep therapy installation of Dr. Benjamin W. Bayless of Louisville, Kentucky.

treated at a time from below or one patient from above and below and any part of the body can be treated. The patients are always in a comfortable



This arrangement makes a very flexible unit, as two patients can be

position, as they are on the back or side. The tubes No. 1 and No. 2

are adjustable under the tables, and No. 3 is adjustable in the half cylinder which is also movable up and down so any focal distance desired is obtained. The tables are lead lined on the top, end, and side with diaphragms cut in the top of the tables over the tubes so the operator and patient are well protected. The table is open on the side next to the machine for placing the tube and making the connections. The half cylinder is lead lined with a diaphragm cut in the lower part below the tube and is counter weighted so is movable up and down and is open above and on the end next to the machine for the connections. The filters are placed in the diaphragms and various size diaphragms are made out of lead to slip in with the filters and used when necessary. The tubes No. 2 and No. 3 are on the same line and, of course, not operated at the same time. The partitions are carried to the ceiling so the machine is in a separate room. The door is lead lined with a window cut in it to observe the machine, meters and sphere gaps. It is not necessary to cover the patient with lead or leaded rubber, as the diaphragm is practically against the part of the body to be exposed and the rest of the body is protected by the lead lining of the tables and the half cylinder. The tables are made long and broad enough so the patient can be placed on the table and any part of the body exposed through the diaphragm. There is a window at the end of each table which makes the ventilation very good. Patients can shift the position of their legs, arms or head to relieve the strain, and if they touch anything there is no danger, as the tubes are placed well away from the tables and all the lead is grounded.

Dr. Bayless has been treating patients with tubes No. 1 and No. 3 at the same time and it shortens the stay of patients on the table one-half, as they get an exposure on the front as well as the back. He does not notice any difference on the patients except they can not take as long exposure with two tubes as they can with one. They are more apt to become nauseated in a shorter time, but there is no more reaction.



NEW EQUIPMENT



The Cameron Adjustable Self-Rectifying Radium Applicator

EVERY user of radium, particularly in those cases where the mouth, tongue, throat or face is involved, will appreciate the serviceability of the Cameron Adjustable Self-Retaining Radium Applicator now being sold by the Radium Chemical Company of Pittsburgh.

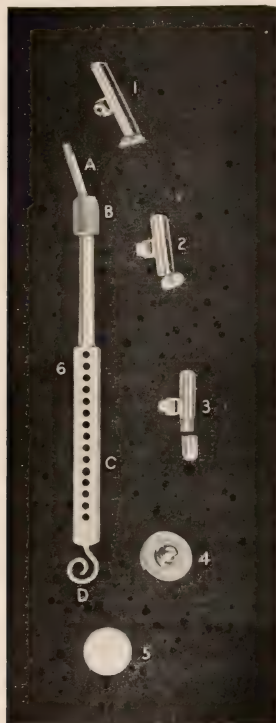


PLATE NO. 1

The value of this device lies in the fact that the radium can be held exactly in the place desired during the entire period of application. An applicator of this kind has been greatly needed ever since radium therapy began.

Nos. 1-2-3 —Radium containers and Plate No. 1 screens (adjustable to various angles) for holding (No. 1) 4 or 5 needles, (No. 2) two 25 milligram tubes, and (No. 3) one 50 milli-

gram tube. These containers are fastened on end of No. 6 at "A" by screw-joint, and when in position may be locked.

No. 4
Plate No. 1 —Slip-on Holding Device (adjustable to various angles) for a specially devised plaque (see No. 5). This device is fastened on end of No. 6 at "A" by screw joint, and when in position may be locked.

No. 5
Plate No. 1 —Specially designed two and one-half strength, flat-surfaced, round, glazed plaque, containing 25 milligrams of radium element. Outside diameter 10 mm. This applicator may be utilized for superficial applications.

No. 6
Plate No. 1 —Adjustable handle for radium containers. This handle is so constructed that by turning "B" point "A" may be ad-

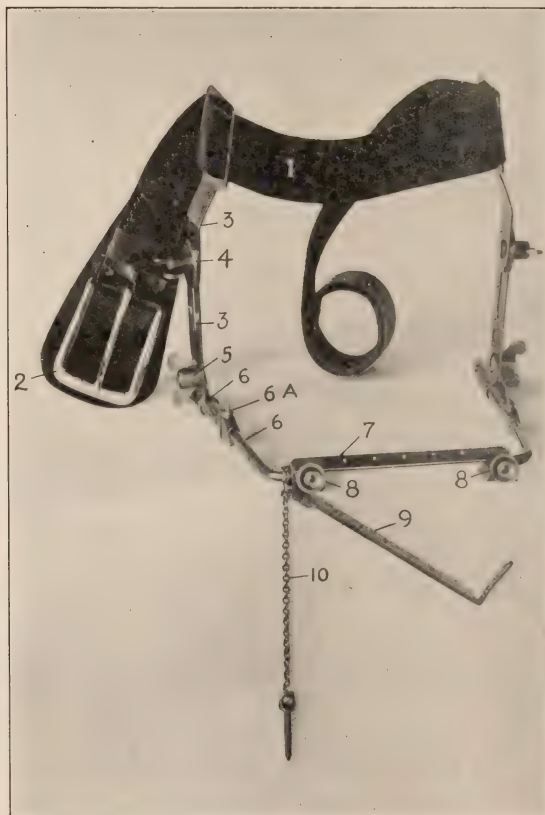


PLATE NO. 2 Holding Device for Radium Containers and Handle



PLATE NO. 3 Showing Device, Radium Container and Handle Assembled

justed and locked at various angles. At "C" the handle is perforated so that it may be held (by pin) in mouth piece of holding apparatus. At "D" is an arrangement for attaching rubber band to make desired pressure of radium containers Nos. 1-2-3-4-5 against part being rayed (see Plate No. 3).

Showing at (1) soft leather head-band and non-slip buckle (2). Adjustable cheek-plate at (3), adjustable by means of thumb screw (4) upward and downward, forward and backward. Connecting rods (6) adjustable forward and backwards by means of thumb screw at (5), and in and out by reason of joint at (6-a). Mouth piece (7) adjustable to any angle by means of ball and socket joint on (6) and fixed by thumb screws at (8). Upper plate (7) of mouth piece perforated to accommodate locking pin (10); pin also passing through perforations in handle of radium container (Plate No. 1). Lower plate of mouth piece (9) hinged so as to drop down while radium container is being introduced. After pin is placed this plate is locked in position, as shown in Plate No. 3.

Rubber band fastened on "D" of Plate No. 1 and either side of mouth piece to make pressure of radium container against part.

The brass end of handle ("A" and "B" of Plate No. 1) is covered with thin rubber tubing, or Doherty's Palate Rubber.

The Standard Iontoquantimeter

THE intoquantimeter is an instrument designed for the measurement of relative intensities of x-rays. It consists essentially of an electroscope and an ionization chamber, conductively connected by means of a well insulated wire cable or rod.

THEORY

Gases under ordinary conditions are very poor conductors of electricity, and smooth bodies like metallic spheres may be charged to a considerable potential, and retain that charge for some time in such gases, for example, air.

If, however, various agents, such as radium, ultra violet light, or x-rays be directed through the gas surrounding the charged sphere, it is found that the charge disappears. This leakage of the charge can be due to only one

cause—that the surrounding air has become a conductor. The process of causing air to become a conductor is called ionization, and resulting air is said to be ionized.

In terms of modern electrical theory, the process of ionization is as follows: An atom consists of a positively charged nucleus, containing practically all of the mass of the atom, surrounded by negatively charged electrons, which revolve around it, possibly in the manner of planets around the sun. In such an atom, the sum of the positive electrification of the nucleus is equal to the sum of the negative electrification of the electrons, and the result is an electrically neutral atom. A gas, then, is composed of such neutral atoms (sometimes combined with themselves to form

molecules), and is practically non-conductive. When x-rays are passed through the gas, they "knock off" an electron from the neutral atom, leaving the remainder positively charged. Such a positively charged atom is called a positive ion. The electron which is free, then attaches itself to a neutral atom, to form a negative ion. After ionization, the gas is in an electrically charged state, and a conductor of electricity. If we now charge the sphere in this conducting medium, the charge "leaks" or is conducted away.

The rate at which a charge leaks from a sphere cannot be measured, but an instrument which will measure the rate of leak of a charged body exists, and such an instrument is called an electroscope.

One of the fundamental laws of electrostatics is that like charges repel each other. If two fine gold leaves are joined together at one end and suspended vertically, and then charged with several hundred volts potential, the repulsion due to the charge causes the

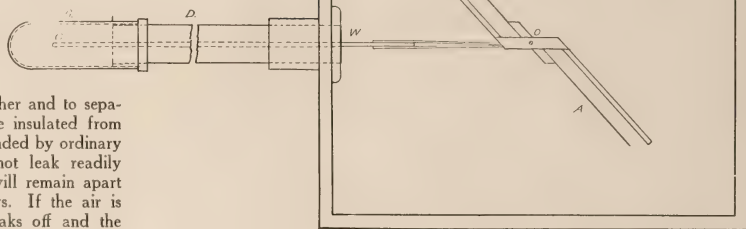


FIGURE 1.

leaves to repel each other and to separate. If the leaves are insulated from the ground and surrounded by ordinary air, the charge will not leak readily from them and they will remain apart for hours or even days. If the air is ionized, the charge leaks off and the leaves fall together much more rapidly. The rate of fall is a measure of the conductivity of the gas.

APPLICATION TO THE MEASUREMENT OF X-RAYS

X-rays ionize air. Air so ionized conducts. We have an instrument for measuring its conductivity; hence, we can measure x-rays.

Figure 1 shows a diagrammatic sketch of the instrument.

"A" is a light aluminum leaf pivoted at "O" so that it swings in a horizontal plane. Its position may be read by means of the scale "S". To the needle at "O" is connected a wire "W" which passes along the inside of the brass tube "D" and is insulated therefrom. It terminates in the metal rod "C". "B" is a light aluminum cap which fits over "D" and is metallically connected to it. "B" and "C" constitute the ionization chamber. The whole system "AWOC" is thoroughly insulated from the ground, and so, if charged, will retain its potential, as measured by the constant deflection of the leaf. If now, x-rays pass through the chamber "B" they will ionize the air therein, and the charge will be conducted from "C" through the air to "B" and hence to ground. As the charge is conducted away from the system "AWOC" the aluminum leaf gradually falls to its normal position. If a great quantity of rays passes through the chamber, the conductivity of the gas becomes greater, and the rate of fall of the leaf greater.

OPERATION

To operate the instrument, the system "AWOC" is charged to a high potential by means of a static charger, after which the position of the needle on the scale is noted. The needle will retain its position for some time, gradually falling to the zero. This gradual "air leak" is unavoidable, due to the natural conductivity of the air. This natural leak under normal condi-

tions is so much longer than the discharging time of the instrument under the influence of x-rays that it is a negligible factor.

The instrument is placed so that the ionization chamber ("B") occupies a position which would correspond to the center of the area to be rayed. The factors including kilovoltage, milliamperage, skin distance, and filter being previously set, the x-ray machine is started, and the time of fall of the leaf between two scale divisions is noted by means of a stop watch. Suppose, now, that the part to be treated is ten centimeters below the surface. The ionization chamber is placed beneath a block of paraffin ⁽¹⁾ ten centimeters thick, the distance to the surface of the paraffin being the same as previously used for skin distance. The time of fall of the leaf between the same two divisions is again noted. Let the time of fall of the leaf at the skin be denoted by T_s and at the depth by T_d . Then the per cent of the original beam penetrating to the depth of ten centimeters, under the conditions used will be:

$$\frac{T_s \times 100}{T_d} \text{ Thus, if } T_s = 10 \text{ seconds} \\ \text{and } T_d = 20 \text{ seconds, the per cent} \\ \text{dose will be } \frac{10 \times 100}{20} = 50.$$

CARE OF INSTRUMENT

This instrument, embodying as it does, the principle of the electroscope, is extremely sensitive. It is a high class scientific instrument and must be treated as such. Any jars or knocks are likely to break the fine pivot bearings of the aluminum leaf. The instrument has been built with the utmost care and precision.

The box housing the sensitive aluminum leaf is thoroughly encased with lead to prevent any stray radiations from entering and causing ionization. The air in the housing is kept dry by means of a small charge of calcium chloride.

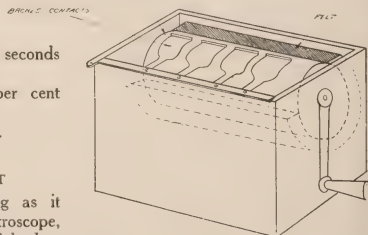
The connecting wire between the electroscope and the ionization chamber is insulated from the grounded brass tube by means of a solid insulating material, which completely occupies all the space between the wire and the tube. This eliminates any possible error due to the presence of ionizable air in the tube.

The instrument is thoroughly grounded to prevent the accumulation of static.

The Standard Ionotoquantimeter has been developed in our laboratories under the direct personal supervision of Dr. Robert S. Landauer. Dr. Landauer was for several years associated with Dr. G. L. Wendt at the University of Chicago, in a study of the effects of ionization in gases.

Drs. A. W. Erskine of Cedar Rapids, Iowa, and B. H. Orndoff, H. Schmitz, A. Bachem, R. A. Arens,

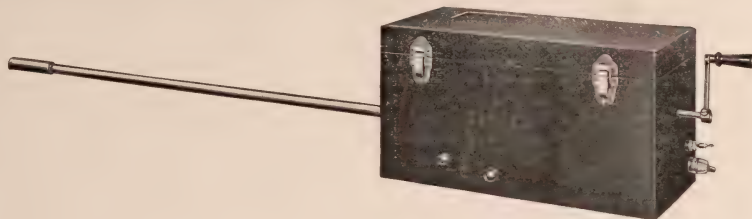
and E. L. Jenkinson of Chicago, were consulted frequently during construction of the Standard Ionotoquantimeter and offered valuable suggestions and criticisms.



(1)—Instead of using paraffin it is considered better practice to use water. Paraffin is a few per cent less resistant

than ordinary tissue, while the resistance of water corresponds very closely to that of tissue. However, paraffin is

more convenient to use, and under average conditions is sufficiently accurate.



Acme Coronaless Overhead System

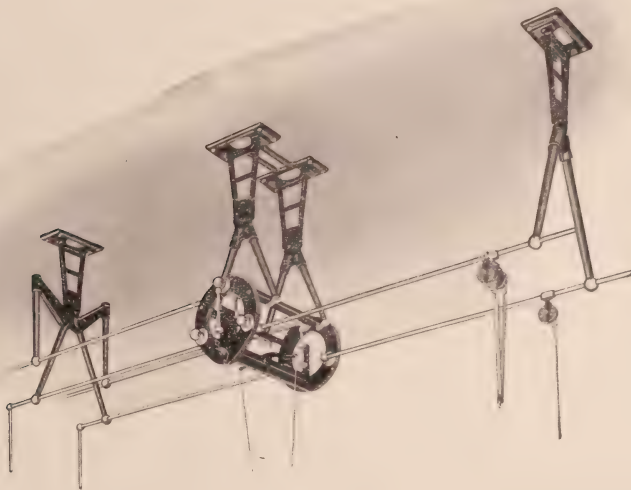
A RADICAL change in the design of high tension overhead systems is made in the coronaless system recently placed on the market by the Acme X-ray Co. of Chicago, Illinois. Excluding the body of the switch, no wood is used on any point of the system, all parts being made of metal and insulating materials. This makes the entire system very rigid and compact.

air is made considerably shorter, so that if the switch is operated on a higher potential than that for which it is designed the sparkover will take place through the air instead of breaking down the switch.

The switch is of the toggle variety and good contact is assured because of the large amount of contact surface and the heavy pressure at the point of con-

tact path is also assured and breakdown of the insulation, due to the use of too high voltage, is prevented as the distance from tube to tube is shorter through the air than along the insulator.

The supports for the switch and insulators are designed so that they can be adjusted to allow for irregularities in the ceiling. In this way, perfect alignment of conductors, which is so neces-



The high tension switch is capable of operating at 100 kv. (effective value). The body of the switch is made of wood finished in dull black enamel. The current carrying parts are so disposed on this frame that at no point is the path from negative to positive through any one piece of wood. In addition to this, the path through the

tact made possible by this movement. Because of the mechanical structure employed, the switch combines a very positive action with remarkable ease of movement.

Horizontal supports are entirely eliminated, thus preventing the accumulation of dust and the resultant partial conduction through it. A longer leak-

sary to the good appearance of the system, can be obtained.

Every possible contingency met with in the installation of high tension systems has been provided for. The system is complete in every detail and a combination will be found to meet every requirement.

Wappler Scale for Measuring Wave Length Radiations

DURING the early part of May, 1922, the Wappler Electric Company announced the perfection of a very simple device for the measurement of wave length radiations. From a reading of descriptive literature it would appear that this scale is patterned after the principle of the Benoist Penetrometer, with which most radiologists are familiar.

Following the experimental verification of the Planck-Einstein relation by Doctors Duane and Hunt, it has been possible to calculate the voltage of the current applied to the tube by measuring the wave length of the rays produced. The wave length is obtained from the angle at which the rays sub tend when refracted upon the surface of a crystal.

Attempts to produce a satisfactory and accurate measuring device by March, Stauning and Fritz, resulted in a simple type crystal spectrometer. But the use of this instrument is a rather complicated matter, and its adjustments are so delicate that there is considerable question whether it will ever prove a practical instrument in the hands of the average practitioner.

It will be remembered that Professor Richtmyer recently published absorption coefficients for various metals at various wave lengths. These tables and curves show that copper and aluminum, vary at different rates for different penetrations or wave lengths. These data also indicate that aluminum is a relatively more effective filter for highly penetrating radiations than is copper, and conversely, for radiation of lesser penetration aluminum absorbs in greater proportion than copper. Accordingly, this fact constitutes the physical reason why copper as a filter is to be preferred over aluminum in highly penetrating radiations.

From these considerations the inference seems well founded that if the rays are passed through a uniform layer of copper next to which is located an aluminum wedge, there should be equality of tints on the photographic plate placed underneath and exposed through the metals. The point at which this effect of incidence harmonizes depends entirely on the wave length or penetrative power of the rays produced.

In principle the device in question consists of a uniform layer of copper and an aluminum wedge placed side by

side. A photograph is taken through both the copper plate and the aluminum wedge simultaneously on one plate. After developing, from a scale which is reproduced on the photographic plate, the most effective or principal wave length or voltage can be directly read off. The calibration curve used for calibrating this instrument has been further extended and checked with voltages measured by standard methods and found to agree satisfactorily.

It is believed the instrument fills an important gap in simple and reliable measuring devices. For precision, simplicity and accuracy, it appears to be superior to many of the devices formerly employed.

Dr. Mutscheller of the Wappler Electric Company says that while this instrument was already completed and calibrated prior to the publication of an article in *The American Journal of Roentgenology* giving experimental curves from which such a type of instrument could be calibrated, comparison of Dr. Duane's data with those from Professor Richtmyer's absorption coefficients shows substantial agreement within the limits of experimental error.



ABSTRACTS and REVIEWS

X-ray Diagnosis of Gastric Ulcer.

Olney A. Ambrose, M. D., J. Missouri M. A., May, 1922, p. 212.

MISTAKES are more frequently made in reading roentgenograms than in reading the shadows visualized by the fluoroscope.

It is seldom that diagnosis of a lesion of the gastro-intestinal tract can be truly rendered without taking symptoms into account. As a rule no abnormality of the gastro-intestinal tract is seen in patients who do not show symptoms directly referable to this region. The author never makes a diagnosis of a gastro-intestinal lesion until he has first proven that there is no other pathology to which the gastro-intestinal condition is secondary.

All findings must be correlated, and while he does not in any way belittle the value and importance of x-ray diagnosis, he insists that x-ray findings must be considered in connection with other findings. History he ranks first in importance, and complete physical examination second, emphasizing especially the examination of the circulatory, respiratory and nervous systems. Chemical analysis of secretions and excretions comes next in importance, and here he remarks that the fractional method, because not yet standardized, is of no greater value than the older method. Fluoroscopic findings he regards as of more value than roentgenographic findings alone.

The patient is permitted a soft diet the night before examination and the next morning is given four ounces of barium insoluble sulphate mixed thoroughly with water or buttermilk and made up with this medium to eight ounces. Five hours later a fluoroscopic examination is made, when it may be necessary to give more of the solution before palpation of the patient in both anterior-posterior and oblique positions. The normal emptying time of the stomach in different individuals varies, but if barium remains in the stomach after five hours the writer calls it retention. A deformed duodenal cap such as indentation, niche, or a partial filling defect, or an accessory pocket are regarded as signs of duodenal ulcer.

After the above examination the hand is placed on the lower end of the stomach and everything is pressed upwards to note possible defects of the stomach. If direct signs of duodenal or gastric ulcer are present the patient is

given one-fiftieth grain of atropin and later re-examined and then, if deformities are still present, real pathology is assumed to be the cause. If not completely satisfied at least three plates are then made for further study.

Indirect as well as direct signs are looked for while the patient drinks the barium. The indirect changes (changes of motility of the stomach) must be taken only for what they are really worth, as many conditions may cause them, but the author regards them as valuable. The direct signs can be relied on in about ninety per cent of the cases.

Veils in the Right Hypochondrium and Their Differentiation from Other Organic Lesions and Spasm.

Lewis Gregory Cole, M. D., Am. J. Roentgenol., March, 1922, p. 137.

THE roentgen findings and clinical symptoms of these veils simulate cancer, gastric ulcer, or postpyloric ulcer or pylorospasm to such a degree that they require special consideration.

Only the "cobweb" adhesions in the right hypochondrium, which occur when the gall-bladder is apparently normal, are here considered.

Harris believes that this veil is an abnormal fold of the anterior mesogastrium, formerly called the "gastro-hepatic ligament," and as described by him it extends from the gall-bladder to the descending duodenum. The writer thinks that this description applies only rarely to veils in the right hypochondrium, but states that veils certainly are present here and cause symptoms which sometimes require operation.

The roentgen findings characteristic of these veils are:

1. The cap and perhaps the extreme pyloric end of the stomach are partly constricted or compressed, and fail to fill to their normal dimensions, particularly on the anterior superior surface.

2. The left superior surface of the cap has a thin feathered-out appearance whereas the right side of the cap has a clear-cut, definite, well-defined line.

3. If the veil also involves the extreme pyloric end of the lesser curvature of the stomach this region has a puckered appearance somewhat simulating the finding observed in cases of prepyloric folds.

4. The pyloric sphincter is clear cut and well defined if the veil involves

only the cap. If it involves the stomach also, the pyloric sphincter, particularly on the lesser curvature surface of the lumen, is irregular and often thickened by comparison with the sphincter on the opposite side of the lumen.

5. The deformity is more marked with the patient in the erect or prone posture, and may be absent with the patient lying on the right side.

6. The line or torsion runs downward and to the right from the gastro-hepatic ligament (megogastrium) toward the gall-bladder, the under surface of the liver, or the hepatic flexure.

7. These veils are rarely if ever obstructive to the pylorus, and if gastric retention occurs it is probably functional rather than organic.

8. If the veil fails to extend as far up as the cap or stomach, it may then involve only the anterior surface of the descending duodenum, causing that to be adherent to the under surface of the liver, gall-bladder or hepatic flexure. This is the type of pathology described by Harris, but the author has seen no case where the veil is limited to the descending duodenum.

9. There may be an angulation, rarely amounting to a partial obstruction, involving the midportion of the descending duodenum.

In about ten per cent of cases the author has found difficulty in the differential diagnosis between cancer, ulcer, gall-bladder adhesions, spasm, and this veil or membrane. In such cases the surgeon should be forewarned so that he may look for a veil in event of failure to find other pathology. It requires as much surgical skill and experience to recognize these veils after the abdomen is opened as it requires roentgenological skill and experience to interpret the x-ray plates.

The author and Dr. J. P. Hoguet contemplate collaboration in writing a monograph upon this subject in the near future.

Possibilities of Roentgen Ray Treatment in Cancer of the Pancreas.

G. E. Richards, M. B., Am. J. Roentgenol., March, 1922, p. 150.

THE author's report is based upon only a few cases, but is presented with the hope of stimulating interest in a subject which he feels holds possibilities worthy of investigation.

Two patients out of three treated are apparently well nearly a year after

treatment; the other one is dead. All three cases were proven by every means possible to be cancer of the pancreas, and the hope of life was not held out to any of these before roentgen ray treatment.

Some other cases have shown gratifying preliminary results, but treatment has been too recent to allow of conclusions in regard to these.

From his experience with this form of treatment the author concludes:

1. It is possible favorably to influence the growth of pancreatic cancer, and this is sufficient justification for intensive radiation of every case as soon as the diagnosis can be established.

2. It appears that adenocarcinoma of the pancreas is more susceptible to irradiation than are some other forms of adenocarcinoma.

3. Efforts should be made to perfect our ability to recognize the disease as early as possible.

Personal Observations Regarding the New Roentgen Technique for the Treatment of Cancer. J. Henry Schroeder, M. D., Ohio M. J., May, 1922, p. 345.

THIS paper gives a brief exposition of the biological effects and the physics of radiation and describes the apparatus and technique for the benefit of the general practitioner.

The writer's observations, made in German clinics, are recounted as follows: "The best results have been obtained in the treatment of cancer of the uterus and the pelvic organs. In the University Gynecological Clinics at Erlangen and Freiburg no surgical operations for uterine cancer have been done during the past five or six years. All cases are treated by roentgen radiation, sometimes in conjunction with radium. Professor Wintz accomplishes what he designates as the Roentgen-Wertheim operation in three roentgen treatments. In the various surgical and gynecological clinics throughout Germany equipment for intensive deep roentgen treatment is at hand. There are usually from two to four machines running eight to ten hours per day.

"For cancer in locations elsewhere than in the pelvis, though equally applicable, roentgen therapy has not been as uniformly successful. An exception to this statement is found in cancer of the breast."

The author has installed an apparatus with a capacity of two hundred and eighty-five thousand volts maximum, capable of delivering a depth cent of the skin dose, through one area of entry, when filtered through heavy

copper filters. Final results, of course, are not yet apparent.

The Relation of Temperature Changes to Roentgen Ray Skin Reactions. Charles L. Martin, M. D., and George T. Caldwell, Ph. D., M. D., Am. J. Roentgenol, March, 1922, p. 152.

THE two extreme views with regard to idiosyncrasy are discussed and are summarized by the statement that the consensus of opinion is that there is a definite susceptibility of the skin of too small a degree to be called an idiosyncrasy; many factors influence this and skin temperature is the one herein discussed.

To throw some light upon this subject a series of experiments was undertaken upon rabbits. These experiments are as yet incomplete, but the following conclusions have been drawn from the preliminary work:

1. Adhesive plaster appears to produce ulcerations upon its removal from an irradiated skin surface.

2. The evidence at hand suggests that a covering placed over irradiated skin causes some increase in the reaction. This may or may not be due to an increase in the temperature of the skin.

3. Cooling the skin by means of an ice bag for several days after irradiation seems to accentuate the reaction obtained.

An Original Method for Lantern Slide Projection of Roentgen Ray Films. Norval H. Pierce, M. D., Jour. A. M. A., May 20, 1922, p. 1539.

TO obviate inversion of colors in plates used for lantern slides it is not necessary to make a second plate from the first, "one may simply place a lantern slide cover plate over the desired portion of the film and cut it out. This portion of the film is then placed between two cover plates, and the edges are covered with passepout. The slide is now ready for projection and will appear on the screen as it does upon the film as regards black and white, without loss of detail."

Radiation Treatment of Uterine Cancer. A. F. Tyler, M. D., Nebraska M. J., May, 1922, p. 162.

CANCER of the female genital organs ranks second in the mortality rate of cancer in the United States. Cancer of the uterus is the most frequent type found, it is found commonly at the cervix, but rarely in the body of the uterus. This latter condition usually allows surgical treatment, but if not radiation is of great value.

Surgical results in carcinoma of the cervix are very disappointing, because patients present themselves too late; radiation therapy has a large field here and even with hopelessly inoperable cases results have often been brilliant and the future holds great promise.

A monotherapy method in malignancy is condemned. Radiation from without and within and surgical treatment where indicated should be used.

The advantages of radiation therapy are: No immediate operative mortality, no anesthetic required as a rule, a short hospital stay, treatment can be re-applied, and all possible lymphatic metastases can be successfully reached.

Two cases of carcinoma of the cervix and one of the vaginal vault are recounted with successful results following radiation treatment.

"Experience has shown that we should introduce the radium into the cervical canal, when this is possible without traumatizing; that radium should be placed against the cervix in the vaginal vault and some radiation should be allowed to impinge upon the walls of the vaginal vault, but we should keep the walls far enough away from the radium so that they do not get too much reaction." Otherwise fistula or occlusion of the vaginal lumen may occur. The radium can be mounted upon dental modeling compound, or gauze may be packed into the vagina so as to keep the walls from the radium applicator, or a metal shield can be used for protection of these parts. Sometimes a lead slug with radium mounted upon one side is used.

Radium in Cancer of the Prostate. Herman C. Bumpus, Jr., M. D., Jour. A. M. A., May 6, 1922, p. 1374.

THIS is a report of two hundred cases from the Mayo Clinic. There are records of seven hundred and twenty-nine patients with carcinoma of the prostate; two hundred and seventeen of these have been treated with radium during the last seven years, and three hundred and sixty-three have not been treated, which gives a basis for comparison.

CONCLUSIONS

"1. Radium therapy should be applied in less than one-half of the patients with carcinoma of the prostate.

(2) One-third of all patients with carcinoma of the prostate will be found to have metastasis at the primary examination. (3) Complete and thorough irradiation of all portions of the neoplasm with minimal doses applied from many locations affords better results than maximum doses applied from a few locations. (4) Prolongation of

life can be expected in only one-fourth of the patients treated."

Diagnosis of Gall-Bladder Disease.
William Fitch Cheney, M. D.,
Jour. A. M. A., April 29, 1922,
p. 1281.

THE subject is discussed under the heading of physical examination, laboratory examination, fluoroscopy and roentgenography, and interpretation of data. The paragraph upon fluoroscopy and roentgenography is here quoted verbatim:

"No one can doubt by this time the value of fluoroscopy and roentgenography in diagnosis. Nevertheless, the evidence given by this method of diagnosis is not infallible and must not be accepted as unassailable. In a given case of gall-bladder disease, it may add nothing to the data collected by the history, physical examination and laboratory findings; and yet its negative report must not be understood to prove all other witnesses wrong. On the other hand, it may appear to implicate the gall-bladder when no disease is there, and call attention to abnormalities that are shown by operation not to be present. It is not fair, therefore, to exalt this method of diagnosis to a pedestal above all others or to claim for its pronouncements the rank of Delphic oracles.

"The evidence obtained by roentgen ray examination is of three kinds: direct, indirect and eliminative.

"1. Direct evidence means the demonstration of changes in the gall-bladder itself, either the shadow of its outlines or of stones within it. But it is admitted that not more than half the cases show such peculiarities in the films even when they really exist in the body; and, unfortunately, at times they show in the films when they do not exist in the body, as proved later at operation. The margin of error is, therefore, a large one, and neither positive nor negative reports are so reliable that they must be accepted if they conflict with the data obtained by other methods.

"2. Indirect evidence means the demonstration given of effects produced on surrounding tissues by gall-bladder disease, such as flattening or deformity of the duodenal cap, reverse peristalsis in the duodenum, displacement of the stomach to the right, or a high fixed position of the hepatic flexure of the colon. All of these signs are produced by pericholecystitis with resultant adhesions between the gall-bladder and adjacent organs. But pericholecystitis does not always occur as a complication of chronic cholecystitis, and, therefore, none of these results may follow.

Their absence is not conclusive evidence against gall-bladder disease, just as their presence may be the result of localized peritonitis originating from disease in the pylorus, duodenum or colon, rather than in the gall-bladder.

"3. Eliminative evidence means the proof given of normal stomach contour and motility, showing that the digestive symptoms are not due to organic disease of that viscus, of no defects in the duodenum, such as are ordinarily found in chronic ulcer, of no cecal or appendix stasis or other evidences of a chronic appendicitis, and of no break in the continuity of the ascending or the transverse colon." These negative findings are of great value, even though no positive signs of gall-bladder disease are demonstrated.

Radiotherapy and Electro-Coagulation in the Treatment of Malignant Disease.

George E. Pfahler, M. D., and
Bernard P. Widmann, M. D., J.
Maine M. A., April, 1922, p. 246.

THE writers believe that pre-operative and postoperative radiation should always be used in operations upon malignancies.

Epithelioma of the skin, if treated early and thoroughly (presumably radiotherapy) should get well. Basal cell epithelioma the authors generally destroy by the high frequency spark and follow this with a full erythema dose of roentgen rays. This method should not be used about the eyelids because contraction may occur from the resultant scar, though with proper and careful technique it may be used; radium, however, can be safely used here.

Electro-coagulation is also used for squamous celled epithelioma and is followed by roentgen ray or radium treatment. Epithelioma of the tongue can be successfully treated by this means if taken early, but that of the cheek is extremely difficult to treat successfully.

For carcinoma of the breast pre-operative radiation followed by operation and postoperative radiation is advocated, but if inoperable radiotherapy offers reasonable hope of success. In recurrences and metastases patients have been known to remain well for periods of years.

In carcinoma of the uterus the great progress made by radiotherapy is progressively diminishing the operative field but "it is far better that a skillful surgeon operate than that a bungling theoretician should treat patients." Proper choice of cases is necessary.

For sarcoma radiation is preferable to excision.

Conclusions drawn are: (1) Radiotherapy, when practical, should be used

preceding and following operations. (2) Electro-coagulation can in many instances be used to replace excision, and to advantage, because the blood vessels and lymphatics are sealed off in the process of destruction and there is a heat zone beyond the area of actual destruction which will destroy carcinoma. (3) Radiotherapy can be used with success in nearly all of the superficial cancers. (4) Radiotherapy will in some instances cause a complete disappearance of even deep seated disease."

The Roentgen Diagnosis of Pulmonary Tuberculosis in Childhood. R. G. Allison, M. D., and R. W. Morse, M. D., The Journal-Lancet, May, 1922, p. 247.

THE work of Kuss, Albrecht, Hamburger and Sluka, Opie and Dunham, also Gohn of Vienna, is reviewed and a report is submitted of a study upon tuberculosis suspects among the grade pupils of Minneapolis schools.

The authors' conclusions are as follows:

1. The primary lung focus in childhood tuberculosis practically always occurs in the parenchyma of the lung and is by the inhalation route.

2. Involvement of the regional lymph nodes and hilus glands is the rule and is secondary to the primary lung focus.

3. The prognosis in primary pulmonary tuberculosis of children is directly dependent on the age at which infection takes place. It is grave during the first two or three years of life and relatively unimportant occurring after this time.

4. Enlargement of the bronchial glands and alteration in the linear markings should not be considered tuberculous in the absence of calcification or a definite primary focus.

5. Adult type tuberculosis occurring either in the child or adult is always a second infection, which is generally from without and by the inhalation route. Its occurrence in childhood is rare and offers a grave prognosis.

A Review of a Year's Thyroid Work.
Frank H. Lahey, M. D., Bost. M. & S. J., April 27, 1922, p. 562.

THE writer believes that many errors in thyroid treatment are constantly being made because of an inadequate knowledge of the clinical classification of thyroid disease and ignorance of the indications for operation in each group.

Adolescent goiter with slight enlargement requires no treatment and the writer doubts if this form of goiter is anything but so-called. Colloid ado-

lescent goiter seen in goiter belts is a different type.

Neither does he believe that there is necessarily a relation between tachycardia and enlargement when both are present. He does not believe that tachycardia of thyroid origin exists without other signs indicative of this disease, nor that the combined presence of tachycardia and enlargement are necessarily related. These two conditions may exist even with a moderate increase in the basal metabolic rate without hyperthyroidism being present. On the other hand, if hyperthyroidism is present tachycardia and increased basal metabolic rate will be present also, but goiter may exist without hyperthyroidism, and vice versa.

Colloid goiters and cysts, when unsightly or intrathoracic or associated with hyperthyroidism, he would operate upon, also upon the latter when they produce pressure. Adenomata he believes should be operated upon if they are producing secondary hyperthyroidism or if they present danger of malignancy, this latter being especially stressed.

In regard to the metabolic test, while the author's study is not yet complete, certain facts have been impressed by this study, "The first and most important one, in our opinion, is that hyperthyroidism has not occurred in this group (five hundred cases) without an increase in basal metabolism rate, so that we feel strongly that operations undertaken upon patients with normal metabolisms will yield consistently poor results * * *

"Finally * * * it is a very grave error to consider thyroid disease in terms of increased metabolism, and * * * such a test can be of as much harm as good unless carefully weighed and correlated with the history and clinical signs presented by the individual."

Hearts in hyperthyroidism fall into two classes, one shows no signs, upon clinical examination, of heart damage, the smaller class shows definite signs of this.

The writer's attitude toward x-ray therapy is exceedingly skeptical. Experimental work tried out under his management and with his selection of cases and interpretation as to cure or relief at the Boston City Hospital, leads him to conclude that surgery is preferable to x-ray therapy. Endeavoring to be fair he states that the cases have been limited in number, and that as a clinician and not a trained roentgenologist, he has had no check upon the dosage, but he immediately counters this statement by one asserting absolute confidence in the accuracy of the dosage

employed by the roentgenologist in charge.

The Value of Basal Metabolic Rate Determination and the Epinephrin Test in the Diagnosis and Treatment of Thyroid Disorders. Emil Goetsch, M. D., Long Island, M. J., April, 1922, p. 154.

THREE of the most practical and helpful tests for thyroid disorders are based upon three functions of the thyroid secretion, namely, "(1) its stimulating action upon the sympathetic portion of the autonomic nervous system rendering it hypersensitive to the action of epinephrin, (2) its stimulating or depressing action upon metabolic processes according to the amount of secretion present, and (3) its effect upon the mobilization of carbohydrates, particularly in the liver, and a retarding action upon the combustion of sugar in the blood, as a result of which hyperglycemia follows when this secretion is present in increased amounts."

The hyperglycemia test for hyperthyroidism is less valuable than the epinephrin and metabolic tests since the carbohydrate changes are not specific for thyroid disturbances and hyperglycemia is influenced by many other factors necessitating their ruling out before the test can be of value here.

Abundant physiological research has shown that the sympathetic nervous system is hypersensitive to epinephrin chlorid and that there is an increased tolerance to injection of epinephrin in states of clinical hyperthyroidism or after thyroidectomy in animals.

This knowledge the writer applied to a study of approximately eight hundred patients suffering disorders of the thyroid gland. All cases were carefully verified by histological study of operative material, and as a result the writer's clinical test for hyperthyroidism was evolved, which, briefly described, is this: "The status of the patient at rest is carefully noted, with particular reference to the pulse, blood pressure, respiration, and the subjective and objective findings such as nervousness, tremor, throbbing, asthenia and vasomotor changes. A hypodermic injection of 0.5 cc. of epinephrin chlorid is then given. Any changes in the findings are carefully noted over a period of an hour to an hour and a half and then compared with the status of the patient before the injection of the drug. A positive test always confirms and usually establishes the diagnosis of hyperthyroidism."

The symptoms following positive and mild reactions to the test are described, these are never dangerous and the majority of them must be present and

must be considered together with the entire clinical picture in order to establish a positive diagnosis.

In exophthalmic goiter (test usually unnecessary) the epinephrin reaction the writer found to be uniformly positive and parallel with the severity of the symptoms. In colloid goiter without symptoms of hyperthyroidism the reaction is negative. In active adenoma with clinical symptoms of hyperthyroidism the reaction is positive.

In obscure cases presenting a hyperthyroid syndrome a positive epinephrin test has often led the writer to advise operation at which adenomata, too small to be seen or palpated, have often been found and their removal has led to striking benefits.

Patients with diffuse adenomatosis are often mistakenly thought to have tuberculosis, neurasthenia, psychoneurosis, effort syndrome, etc.; the metabolic rate is not increased in these cases and they are therefore overlooked. A positive reaction to the epinephrin test led to operation in fifteen such cases with considerable consequent success.

The epinephrin test is also a guide to the amount of thyroid extract administered in cases of hyperthyroidism, myxedema and cretinism.

As a guide to differential diagnosis in tuberculosis, psychasthenia, psychoneurosis, hysteria, neurasthenia, dementia precox, melancholia, alcoholism, tabagism, acromegaly and arteriosclerosis as well as in some other diseases, the test is of great value as essentially negative results are given.

The writer does not hold that the test is absolutely pathognomic of hyperthyroid states—there are a few states which give a more or less typical reaction, but careful history and physical examination clears up such cases. The test is practically always confirmatory, in some other cases diagnostic and in other suggestive.

The test is readily understood, performed and interpreted, having an advantage here over the basal metabolic rate test. In mild and latent cases of hyperthyroidism it is more sensitive than the basal metabolic rate test, though this latter test is of distinct advantage in early diagnosis of hyperthyroidism and is a very useful guide to the form of therapy demanded by the case in hand, and also functions usefully as a check during treatment. The faulty technique and interpretation of this test are briefly dwelt upon.

The Roentgen Rays as an Aid in the Diagnosis of Diseases of the Mastoids and Nasal Sinuses. Joseph Asprey, M. D., Northwestern Med., May, 1922, p. 136.

NO originality is laid claim to by the author. He states that his thesis represents an endeavor to correlate and repeat certain ideas, facts, and observations with the hope that a more frequent use of the roentgen rays in the conditions under discussion will be stimulated and found to be helpful; he believes that the value of the rays is not yet appreciated as it should be, not only in positive or suspected mastoids, but in sinuses.

His conclusions are as follows:

"1. Recognition of the infantile type of mastoid in cases with middle ear infection, plus a drooping of the superior canal wall, calls for exploration of the antrum early, even without clinical signs of mastoids, thereby eliminating a large percentage of chronic mastoids and brain abscesses.

"2. The presence of the pneumatic type of mastoid with definite evidences of mastoiditis, but without cell necrosis or bone absorption, does not always call for immediate operation other than paracentesis of the ear drum.

"3. Information gained by radiographic examination of mastoids with knowledge of the structural type enables us to more definitely predict the clinical course and prognosis of middle-ear infections.

"4. Proper technique with films from different positions and intelligent interpretations are of definite value in diseases of all the nasal accessory sinuses and of all suspicious or pathologic mastoids."

The Value of Interstitial Radiation.

Douglas Quick, M. B. (Tor.), Am. J. Roentgenol., March, 1922, p. 161.

WORK now under way may place radium in the class of constitutional agents, but until such time the problem of more accurate radium application calls for attention.

The history of radium technique is outlined up to the advent of therapy by means of radium emanation in buried tubes, which has now reached a practical working standard. The smaller tubes and needle and the fact that the trocar needle is withdrawn reduces the necessary trauma, and properly used will not result in necrosis about the buried tubes. Equal distribution (using more tubes of buried individual value if necessary) and keeping well to the periphery of the growth is very important, since the periphery represents the actively growing and infiltrating border. When practical, emanation should be implanted in the healthy tissue just at or as near as possible to the infiltrating base of the neoplasm. The writer believes the greatest use of

radium in the future will be in this direction.

All new growths of distinct bulk can best be managed by interstitial imbedding and this method is also useful when it is found impossible to keep surface applications in place. The treatment of primary intraoral lesions excludes surgery altogether in the writer's clinic.

In rectal, uterine, and breast groups interstitial radiation has played a part which could otherwise not have been handled. This is true also of parotid tumors.

The method has been used in all neck wounds following neck dissections and in tumors found inoperable upon incision. Complete regression from one to four years has followed.

There are important possibilities for the use of this method in intra-abdominal new growths.

The Diaphragmatic Pinchcock in So-Called Cardiospasm. Chevalier Jackson, M. D., Reprint from *The Laryngoscope*, January, 1922.

"IN the past different pathological conditions have been erroneously classed under cardiospasm." The author has demonstrated that the stenosis is not at the cardia and Mosher has demonstrated that it is not always spasmodic. This has been further confirmed by clinical observation. Out of hundreds of cases of so-called cardiospasm the author has found none in which the spasm at the hiatus was greater than a maximum normal. His conclusions are:

"1. The diaphragmatic pinchcock is the normal mechanism by which, along with kinking of the esophagus, the food in the stomach is prevented from regurgitation.

"2. The diaphragmatic pinchcock opens at the proper moment in the deglutitory cycle.

"3. It is the failure of the diaphragmatic pinchcock to open normally that constitutes the stenosis in so-called 'cardiospasm,' and not an excessive degree of spasmodic contraction.

"4. The diaphragmatic pinchcock is the local mechanical means by which the esophageal stenosis is produced in those cases of so-called cardiospasm in which the condition is really a spasmodic one."

Pneumoperitoneum as Aid in the Roentgenologic Diagnosis of Lesions of the Urinary Tract. L. R. Sante, M. D., Reprint from *Jour. A. M. A.*, 77:982, Sept. 24, 1921.

PNEUMOPERITONEUM has greatly enhanced the diagnostic

value of the x-ray, although the full value of this method is not yet known. The point has been reached, however, where more specific examinations may be conducted by this method than at first, and the method can be used without great discomfort to the patient and with comparative safety. Conception of the normal is of course a prime requisite for a working basis.

The method can be used to determine the presence, position, size, form or outline, mobility and attachments of the kidney, and these specific points are all dealt with in the original paper; tuberculosis of the kidney and small carcinomatous nodules which can not be palpated can be detected as can also congenital cystic kidney.

The demonstration of intra-abdominal masses and the determination of their origin and attachment is possible. The retroperitoneal character of masses can be established and their involvement of the kidney determined.

The method is valuable also in the diagnosis of special conditions peculiar to urinary tract examination, but examination of the kidney for stone by this method should not be made until all else has failed. "Shadows suspicious of stone over the kidney area can be definitely localized to the kidney. Injection of opaque material into the ureter and kidney pelvis can in most instances be observed during its injection, giving valuable information as to obstruction from kink or stricture of the ureter. Observations of the bladder wall are possible and the connections of pelvic masses to the bladder can be shown."

Details of technique are given in the original paper.

More About Actinic Rays. Howard Plank, M. D., Am. J. Electroth., April, 1922, p. 109.

THE author expresses considerable satisfaction with the recognition that is now being given actinic rays by the general medical profession.

Data are at hand and evidence will shortly be submitted proving that chemical changes are produced by the action of the actinic rays upon the blood.

It is positively stated that if the actinic rays are given after a series of x-ray treatments that the x-ray treatment may then be renewed and increased without danger from surface burns.

Gastric ulcer, dry gangrene, and fistula are some of the lesions successfully treated by the writer.

Electrical Methods in the Treatment of Tonsils. William D. McFee, M. D., Am. J. Electroth., April, 1922, p. 112.

"THE only contraindications for electro-dissication treatment are submargined tonsils and in children below ten years of age." The advantages of this treatment are no confinement or after care, no anesthesia, no pain, no traumatism, no hemorrhage, sepsis or other dangerous complications, and no recurrence if thoroughly and properly treated. The chief disadvantage is that it takes more time, the average case takes about six weeks to reach its maximum of improvement. "Hypertrophy is reduced in practically all cases to that of normal, and even less than normal in size, and crypts are obliterated. The resulting scar tissue also forms a protective covering to the tonsil surface."

* * * In a series of more than one hundred cases extending over a period of fifteen years there has been no appreciable recurrence of tonsil tissue, and the tonsil did not again become the seat of diseased processes."

The technique is described and notation made as to proper selection of cases.

Radiology and Physics. G. W. C. Kaye, O. B. E., M. A., D. Sc., Arch. Radiol. and Electroth., April, 1922, p. 336.

A KNOWLEDGE of physics is greatly lacking and greatly needed in the medical profession. It is especially detrimental to radiologists that the medical curriculum, heretofore, has held the study of physics to be of so little importance. "They have grown to realize the enormous part that radiology will play in medicine in the future and they further realize that if radiology is to advance as it should they will have to correlate it continuously with physics, which is ever advancing."

German achievements in radiology have always been due to the fact that the German "discovered that the secret of progress in radiology was to bring the medical man and physicist continually together and let them work side by side. He went further and introduced them to the manufacturer, but that is another story." The question is asked whether the British radiologist is in a position to submit rival techniques, backed up with a corresponding wealth of physical and scientific data.

The suggestion is made that the Royal Society of Medicine give whole hearted support to securing the appointment of part or full time physicists to the various hospitals, and further, to insure that the universities and other teaching centers provide physicists with

courses of instruction calculated to turn out men of the right calibre and training.

The greater part of the paper deals with the subjects of the physics of the x-ray spectrum, absorption and scattering. A suggestive statement is that while there is knowledge of the existence of over thirteen octaves of x-rays, or including radium gamma rays nearly sixteen octaves, the radiologist has as yet turned only about three octaves of these to account.

Greater unity and co-operation in all phases of the work is urged.

The Care of Radium in the Hospital. Howard A. Kelly, M. D., Mod. Hosp., May, 1922, p. 407.

FOR the preservation and for the protection of workers, precautions must be taken and carelessness and theft also must be provided against.

Some one person should be responsible for knowing at all times just where the radium is, and this individual should keep count each time it is changed and also check it upon its return to the safe.

In the clinic at Johns Hopkins Hospital the workers are protected by cutting down to a minimum the exposure of the personnel, by screening off the radiation while the emanation is being pumped off and manipulated in transference to its final containers, and by eliminating the dangers from unavoidable leaks by means of strong ventilating fans which rapidly change the atmosphere of the room. Also the staff of technicians is composed of six, each individual serving one day a week, which avoids the cumulative effect upon the blood and does not impede the worker's efficiency by long periods of detachment from duty.

Furthermore, the very simple pumping apparatus in the vault shortens the time of exposure, the pumping may take from twenty minutes to one hour. Around the bulbs which contain the stock radium solution is disposed a three inch lead wall between the operator and the radium, in which a ton and one-half of lead was used. When the emanation is being pumped out of the inner apparatus and while it is being propelled through the glass tubing to the mercury bath where it is collected the operator is protected by a screen of lead one inch thick. During the early stages the emanation is not as dangerous as it is later on.

In placing the emanation into apparatus for treatment the nurse is protected by the radium being placed in a lead lined box, which rests upon an iron safe in which needle points are kept, and which has a heavy lead up-

right plate, in front of which she stands, thus protecting the breast and thyroid. Direct contacts are avoided by using forceps and tongs twelve to fifteen inches long. When taken from here for treatments the emanation is held as far as possible from the body and is then kept at a distant point of the room until the moment it is needed.

A head nurse remains permanently on duty as instructor, but never gives treatments.

The three other nurses remain on duty for six weeks at a time, alternating two weeks of day work with two weeks of night work.

The blood of doctors and technicians is examined at regular monthly intervals and that of nurses is examined upon entering service and upon leaving at the end of the six weeks period. Great individual differences in the resistance to blood changes are discovered and it has been found possible to select a group for this duty who are not susceptible to the rays, and these nurses are not called upon to serve oftener than once a year, and it is thought that this can soon be changed to once in six months with safety.

Dental Roentgenography in the Light of Clinical and Pathological Findings. Allan Scott Wolfe, D. D. S., Am. J. Roentgenol. March, 1922, p. 186.

AN oral film alone does not give sufficient basis to decide upon either retention or elimination of teeth. A knowledge of oral anatomy and histology, so often made use of, are apt to lead to mistakes and almost invariably this is true if no check is exercised. Gross errors arising from an ignorance of anatomy (the dental foramen, etc.) are mentioned briefly. This lack of knowledge must be replaced by accurate knowledge, far greater than most roentgenologists now possess.

With this knowledge of anatomy the next requisite is that films of each side of the oral cavity be taken and compared. Two or three films are not enough upon which to base diagnosis. It must be kept in mind that the results of infection and not the infection are what is produced upon the film, and even then it must be remembered that appearances are often deceitful.

Most dental operations are failures in the long run. Retreatment of teeth is condemned and over-elimination rather than under-elimination is advised. "The encysted area is nothing more than a slow-growing mass at the apices of pulpless teeth * * * may be granuloma or cyst, sterile or infected; it makes very little difference. It should be removed after extraction

with a dull curette, otherwise the extraction of teeth is useless."

Morbid conditions are classified as apical, pyorrheal, and nerve irritants. Added to these are "the lower border of the maxillary sinus and injury to the maxillary bone such as a fracture."

In systemic pyorrhea (all cancelled bone over all the teeth permeated with pus) elimination is called for; but the disturbance may be local and due to lack of contact, to contour, or to poor occlusion, and in these cases aid may be given without extraction.

Impacted teeth, hypercementosis and pulp nodules are discussed in relation to nerve irritation, also dental conditions connected with pathology of the maxillary sinus are discussed.

The author states his practice is this: "In all cases of systemic infection or nerve irritation, accompanied by lowered resistance, it is my practice to eliminate entirely all pulpless teeth which show a break in the periodontal membrane, and also nerve irritants (such as retained cysts or residual infection, pulp nodules, hidden cavities) never venturing an opinion upon roentgenographic evidence alone without clinical observation."

Remarks on the Dosage of Radium and the Form and Method of Its Application. Carroll Chase, M. D., Reprint from the Urologic and Cutaneous Review, January, 1922.

THIS paper considers the proper amount and form in which to use radium and the proper method of its application.

The amount to be used depends upon the condition to be treated, and to state the minimum amount of radium necessary to treat the entire range of cases is considered a difficult problem—from one hundred to several hundred milligrams is given as a probable range. The cases that can be treated with small quantities, when the general run of cases is considered, are in the minority. The quantity to be used to advantage can often be determined only by experience.

The proper form in which to use radium is often difficult of determination, and widely speaking, the choice lies between a salt of radium and its emanation. In superficial disease flat varnished applicators may be used, or radium salt in tiny glass tubes gives much the same effect when lightly screened. Radium emanation can best be used in practically all cases where the salt of radium is indicated. It is not easy always to decide upon the proper form of application, particularly as increased knowledge and experience

are constantly bringing changes in technique.

To treat conscientiously all the widely varied cases suitable for radium therapy it is necessary to have a sufficient quantity of emanation in one of the following forms: First, a steady source of emanation in very considerable amount, some of which must be in the form of tiny glass seeds of one to two millicuries each; second, enough of a salt of radium contained in small platinum-iridium needles, and besides this a further supply either in the form of varnished applicators or in the usual small glass tubes, the platinum needles alone are not suitable for all cases; third, enough emanation to use in selected cases, as well as a sufficient quantity of a salt of radium, partly in needles and the rest in the form of varnished applicators, or in the small glass tubes.

The choice of method is too broad a subject to be treated in a short article, but there are four basic factors to be kept in mind in regard to this, namely, the amount, the time, screening, and distance. The practice of stating the dosage in terms of milligram hours is not scientific, since the effect of one milligram applied for one hundred hours and one hundred milligrams applied for one hour is not the same. Often it is wise to give one large dose instead of several smaller ones at intervals, particularly is this true in surface cancer.

Time should be stated in minutes or hours, and this factor varies greatly with the condition under treatment.

Screening varies greatly from none at all to two or more millimeters of lead, and the advantages of the different filters are taken up in this section and secondary filters are also discussed.

The question of distance is frequently too little considered and too little understood.

"The internal use of radium, whether by intra-venous injection, by drinking water, or by other methods, has, perhaps, not made the progress in this country that it should. Its usefulness in a wide variety of diseases has long been proved by the excellent results obtained at the various mineral springs, both here and abroad."

American Literature on Radium and Radium Therapy Prior to 1906. Carroll Chase, M. D., Am. J. Roentgenol., December, 1921, p. 766.

THIS article is a brief resume of the history of radium and contains a valuable bibliography upon the subject, dating from 1906 and including books, articles and editorials from medical

journals upon the subjects named in the title above.

Tumors Involving the Oral Cavity, Upper Respiratory Passages, and Ears, and Some Observations Following the Use of Radium. Margaret Armstrong, M. D., J. Iowa M. S., May, 1922, p. 187.

THIS paper gives a comprehensive description of oral tumors.

The so-called epulis, the giant cell and round cell spindle mixed and melanotic sarcoma are first described.

The embryology of the teeth is reviewed to give a basis for adequate explanation of the origin and development of dental tumors. Under this heading root cysts, simple dentigerous cysts, multilocular cysts, and solid odontomata are described.

Carcinomata of the oral cavity are next dealt with, their incidence, etiology, location and prognosis discussed. Carcinomata of the pharynx and tonsils as well as sarcomata and benign growths in these regions are treated throughout several paragraphs.

Radium offers the best chance of cure or relief of these neoplasms, but surgery should in some cases be combined with this treatment.

Three case reports are appended.

Two Advanced Cases of Carcinoma of the Face—A Warning Against Delay in Treatment. Howard A. Kelly, M. D., The Therapeutic Gazette, May 15, 1922, p. 308.

TWO pictures of very advanced cases of epithelioma, which have destroyed almost the entire face are shown in the original article. The writer states that these photographs have been very useful in persuading patients with beginning cancer of the face to take the necessary treatment before too late.

In happy contrast to these pictures are four others of patients cured by radium—and the writer insists that "cured" is the proper terminology, and he speaks from large and long experience.

It has been estimated that nine-five per cent of these growths can be eliminated by radium with proper dosage and technique. It is important that the first treatment "knock out" the disease and that the sound tissues underneath be not injured. The use of radium is an art and too many attempt its use without sufficient skill. The capable radio-therapist can attain success even in some of the most advanced of these cases. Large growths must never be treated with small quantities (twenty, thirty, or fifty milligrammes) of radium.

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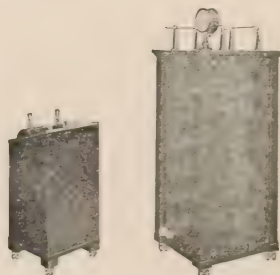
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Radio-Toxemia---Its Cause and Suggestions for Its Prevention

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Chicago, Illinois

THE problem of radiotherapy would be much simplified if it were not for the danger of roentgen or radium toxemia, which is one of the greatest obstacles in the employment of radio-active agents.

As a prerequisite for the solution of this toxemia problem, we must first familiarize ourselves with the following questions: (1) What are the symptoms of radio-toxemia? (2) What is its cause? (3) How can it be prevented?

Before we can answer these questions with any degree of certainty, we must learn to understand the effect of radio-active substances or x-ray upon the normal cells of the body and also upon pathological structures, such as diseases or tumors.

I.

SYMPTOMS OF RADIO-TOXEMIA

From the earliest times of x-ray and radium therapy, it has been observed that patients may become ill shortly after the application of the radio-active agents. The severity of this illness is dependent upon the dosage of either x-ray or radium. Large doses or overdoses have led even to fatalities.

The principal symptoms are increased lassitude, often so marked that the patient can scarcely lift his head or arms; he has a feeling of dizziness, and in the more severe cases there is palpitation, nausea and cold sweats. I have seen cases so ill after large doses of radiation that they reminded me of patients who are nearing exitus from general septicemia. At the height of the toxemia the patients usually develop a diarrhoea, even when they have previously been constipated. The symptoms usually appear twenty-four hours subsequent to the treatment, at times earlier if the patient is either in poor condition or susceptible to the poison. These symptoms persist for three or four days, when the patient begins to develop some appetite and the other symptoms become less marked every day, so that within ten days to two weeks they have practically disappeared. The intensity of the symptoms and their duration vary considerably, depending, of course, upon the degree of intoxication.

Animal Experiments

The same symptoms that were noted in patients have also been produced in the lower animals by radiation. Experiments of Doctors C. C. Hall and C. H. Whipple ⁽¹⁾ with Coolidge tubes on dogs have given the following results: There was a latent period in almost all cases of twelve hours to two days, during which time the animals appeared perfectly normal. After this period there was a marked vomiting, diarrhoea and loss of appetite; but water was taken eagerly. The maximum intoxication appeared on the fourth day and usually terminated in death. If the animal survived the fourth day, it would usually recover.

The anatomical changes were as follows:

Spleen: Decreased in size, fibrous and contained fewer lymphocytes.

Bone Marrow: Decreased in all cells. No constant abnormalities.

Gastro-Intestinal Tract: Contents slightly blood tinged or even quite dark in the colon; but no ulcers of any kind.

Stomach: Usually normal.

Small Intestine: Mottled mucosa with patches of congestion often more marked in the jejunum.

Colon: May be contracted and some patchy congestion.

Crypts: Show degenerated epithelium and large clumps of polymorphonuclear leukocytes grouped about this epithelium.

Another interesting experiment has been done by Dr. H. J. Mack ⁽²⁾ by injecting the active deposit of radium into the veins of animals. They were first affected with digestive disturbances such as vomiting and diarrhoea, associated with considerable loss of body weight. In some cases there was a rise of temperature, suggesting a reaction on the part of the animal organism to meet the toxic condition produced by a considerable amount of destruction of cellular material. When same doses of radio-active solution were again administered after the animal had apparently recovered from the first large injection, the same symptoms recurred. The organism is, therefore, not immunized against the action of a subsequent

injection of radium; on the contrary, the symptoms are more marked on account of the cumulative effect from the previous poisoning.

In our experience we have noticed that patients who have passed through the toxemia and seem normal are just as susceptible, if not more so, to a repeated attack of toxemia than they were at first. At times one is uncertain as to whether the patient has a radio-toxemia or whether he is ill simply from the effects of his disease. The symptoms of radio-toxemia resemble very much that of other types of toxemia; especially the one that is associated with the late stages of cancer. To determine which it is becomes a very important factor in such cases, as one is uncertain whether to repeat the radium treatment or to withhold it. My rule has been to withhold treatment when in doubt, because the doubt will be cleared up within a short time. If the patient is suffering from radio-toxemia, he will soon begin to improve, as the toxic products are being gradually eliminated, while a toxemia produced by cancer itself will continue and the patient will constantly grow worse.

II.

CAUSES OF RADIO-TOXEMIA

The term "radio-toxemia" itself suggests its cause. The exposure of the body to the rays of radio-active substances or the x-rays, produces the symptoms just described. The rays, however, are not the actual toxic agents; it is their action upon the cellular structures that produces the toxic products. Each cell and fiber of the body (whether normal or pathological) will undergo a certain change when subjected to radiation. What form of change will take place is dependent upon the dosage of radiation and the time of exposure, and also upon the radio-sensitiveness of the cell itself. Some cells are highly radio-sensitive while others are radio-resistant. In other words, some cells are readily affected by the x-ray, while others are not. When the dosage of radiation is small little damage will be done to either the normal or the pathological cells, but as the dose is increased the damage to the

cells will increase until finally they will be destroyed.

This contradicts the assumption that the rays have a selective action upon certain cells. The rays themselves have no selective power; they bombard all structures alike and injure more or less all living organisms. It is the resistance of a particular cell which determines whether it will survive a certain dosage of radiation or whether it will merely be wounded and apt to recover.

The end products of cellular or fibrous tissue destruction are highly toxic, and since they must be absorbed into the circulation before they can be eliminated, they produce the toxic symptoms described.

This leads us to a most interesting observation of cellular changes as a result of radiation in cancer therapy, described below: *Morphologic and biologic changes of normal and cancer cells after radiation:* (a) stimulation, (b) sterilization, (c) death of cell.

A thorough knowledge of the histological changes in the tissues occasioned by radiation, is not merely a matter of scientific interest, but is also of extremely practical value. Indeed it is the foundation and a necessity for successful therapy. At first glance it appears to be a simple matter to deduct from the literature and one's own experience, an up-to-date resume of the knowledge of this subject; but as we begin to analyze the work of many investigators, we meet with such a vastness of special investigation that we can here only mention those facts which are essential for practical purposes in this work.

In the application of radium or x-ray we must take into account the fact that the body consists of two kinds of tissues: First, the stationary such as the bones, muscles, secretory, excretory and digestive organs, the connective tissues, etc.; and second, the migratory or circulatory tissues such as the red blood cells, the leukocytes, lymphocytes, etc.

When radiation is concentrated upon a certain area in the body, the rays bombard the stationary tissues, but inasmuch as the blood constantly circulates through this part of the body, the blood cells must of necessity be affected also. As the blood stream passes through the radiated part, the cellular constituents of the blood as they pass through receive a charge of the radiations. It is thus evident that deep therapy affects the entire volume of blood in the body.

Some Factors Which Determine the Tissue Changes

1. Dosage of radium or x-ray at source.
2. The distance of the radio-active



Figure I.—Wound left open for subsequent application of either x-ray or radium.

- substance or the anode from the body.
3. The length of time of exposure.
4. The thickness of the intervening tissues.
5. Interposition of artificial filters, their density and thickness.



Figure II.—Tumescence enlarged to size of large grapefruit.

Results of Radiation upon the Tissues

1. Small amount of radiation has the tendency to accelerate the growth of the tissues; it causes proliferation of the cells. (This has been contested.)
2. Larger doses will paralyze the reproductive power of the cells and thus retard or entirely inhibit the growth without actually destroying the life of the cell.
3. Massive doses will destroy the life of the cell. It is disintegrated and the end products are absorbed in the body and eliminated through the excretory organs.

This applies to all living cells, but some cells are more resistant than others to radio-active application.

Changes in Normal Tissues: The investigations of this subject began when in 1898 Professor Albers Schoenberg introduced the x-ray for metrorrhagia in cases of myoma of the uterus. It was discovered that the women so treated became sterile and histological changes took place in their ovaries. These changes were studied by Halberstaedter, Schiffmann, Levant, Regaud, Huessy and Wallart, Rost-Krueger, Edelberg and others.

It was found that through the energy of the rays considerable destruction of epithelial cells of the follicles took place and that the ovum became succulent and the nucleus broken up, and thus the cells were killed. Some varieties of normal body tissues proved to be only slightly affected or injured by radium or x-ray except when very large doses were applied. The cornea for instance is only slightly radio-sensitive. The brain cells are spared while intracranial tumors treated by radio-therapy may disappear.

By radiating turtles and frogs Levin⁽³⁾ found that the lymphocytes of the circulating blood were more radio-sensitive than the leukocytes and erythrocytes, a release of the polymorphonuclear leukocytes from the bone marrow, and an over production of the same by the blood forming organs.

This specific radiosensitivity of lymphocytes explains the action of radium and roentgen rays on normal and diseased lymphoid tissues. The destruction of the lymphocytes in the lymphoid tissues is associated with



Figure III.—Inspection of cavity, showing bronchial opening.

endarteritis obliterans and finally the formation of dense connective tissues.

Changes in Pathological Structures: Normal lymphoid tissue is less radio-sensitive than the various types of hy-

perplasias, bacillary infections, lymphomas and sarcomas. Hodgkin's disease and lymphosarcomas are extremely radio-sensitive and enlarged spleens shrink to normal size under radium and x-ray influence.

The changes in cancer cells were studied by Handley of Bonn⁽⁴⁾. He compared the microscopic sections of a carcinoma that had been rayed for three weeks with those of the same tumor which had not been rayed. In the rayed specimen small groups of carcinoma cells were surrounded by connective tissue. The individual cell was larger and flat and on account of the large amount of protoplasm in each cell, the entire specimen seemed much paler. In large magnification it seemed edematous and did not take the stain very deeply so that the finer structures of the cell were not clear while a number of other cells were full of vacuoles and stained faintly. Even the protoplasm varied in its intensity of staining, one cell being brighter than another. The outlines of the cells were rather sharp. Karyokinetic changes were found very rarely after radiation; but at times there was abnormal proliferation of the cells. In cases where radiation was kept up for a long period further changes took place. The carcinoma cell groups began to diminish in size; the connective tissues increased, and in a great many of the cells there were fine black spots something like dust sprinkled throughout the entire cell. This was no doubt due to destruction of the nucleus, the nucleus becoming smaller and smaller until it finally disappeared, and nothing but the protoplasm was left which finally also disintegrated. Some of the cells, however, remained almost normal.

Dr. Joseph Beck and myself have been able also to verify the findings of Handley in several cases of carcinoma which had been radiated. Apparent recurrences such as glands in the neck, easily palpable, remained stationary after radiation. The health of the patients was not in any way impaired; on the contrary they kept on gaining in weight.

III.

PREVENTION OF TOXEMIA

If this can be accomplished it will mark a great advancement in radio-therapy. I desire to make some practical suggestions which may bring us nearer to its solution.

In the superficial growths such as epithelioma of the mucous membrane or skin, or in cases where small dosage of rays is employed, the danger of toxemia is negligible; but in deep-seated growths of large size such as tumors of the lungs and liver, or in Hodgkin's disease, the danger is great and we are

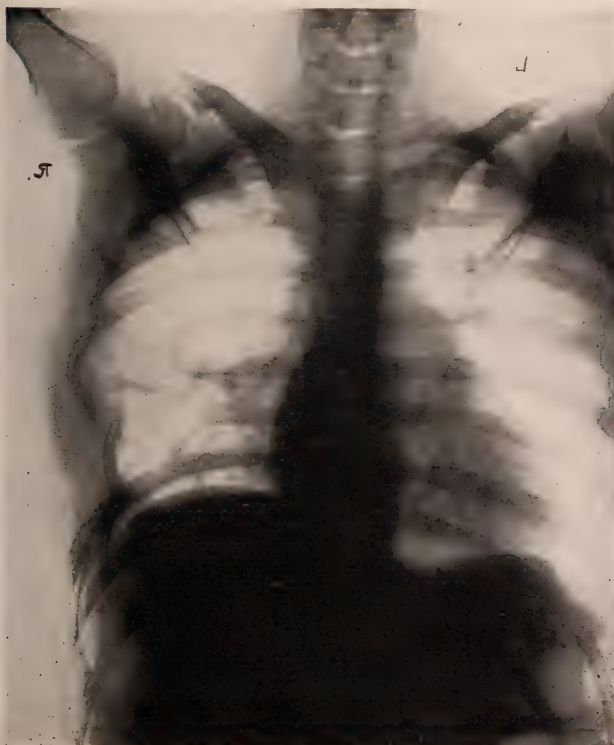


Figure IV.—Four weeks after operation. Small remnant of tumor mass and tumor wall very thin.

faced with a difficult problem. If we administer smaller doses than necessary for the complete destruction of every malignant cell, the treatment is almost useless, and if we give such dosage as is required to kill all malignant cells then the damage produced by the toxic products due to the breaking down of diseased as well as normal tissues, is so severe as to endanger the life of the individual.

When a tumor deeply seated in the body is to disappear through the action of the radium it must first become liquefied before it can be absorbed. In other words, each cell of which the tumor is composed before it can be eliminated must first die and be reduced into an absorbable liquid which can be taken up by the lymphatics and carried through the blood stream until it reaches the excretory organs, the kidneys, the skin and the lungs. Just as the solid foodstuffs we eat must first be transformed by the digestive organs into a liquid and carried through the body before they can be finally transformed into the cellular or fibrous structure of our body, so must all cells and fibers be first liquefied before they can be eliminated.

We have already stated that this rapid breaking down of the tissues causes toxic products which are the actual cause of the symptoms described as radio-toxemia, and since the process of breaking down is a protracted one lasting from one to three weeks the elimination of the toxic products is at times unable to keep pace with the rapidity of formation of the poisonous material. In other words, the poison forms faster than it leaves the body, and thus accumulates.

Rapid elimination is of course a very essential part of the treatment. The kidneys and skin must be kept active without relaxation. Water in large quantities is to fill the arterial tree and the flushing of the bowels is very important in order to get rid of every possible atom of the poison. There are no antidotes known to counteract the harmful effect of the toxic product, elimination from the body is the only remedy.

I have, however, a more practical suggestion than this treatment. Its name is Prevention. I am sure that the toxemia may be prevented in most cases. If we are able by radical surgery to expose the tumor and remove as much of it as is consistent with safety to the patient and then leave the wound open no matter how large it may be, so as to be able to give direct application of the radio-active agent into the cancer bed, we may prevent the toxemia.

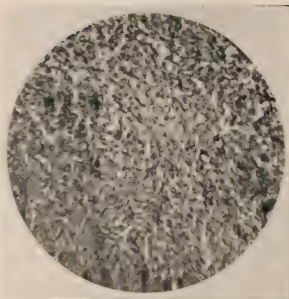


Figure V.—Microscopic section, showing spindle cell sarcoma.

The surgical procedure is, as follows: *We remove the skin, the fat and the muscles and as much of the tumor as is safe or possible.* This sometimes leaves a perfectly clean field and no visible remnants of the growth; at other times, it is possible only to remove part of the growth because it is attached to or imbedded in vital organs. No attempt is made to diminish the size of the wound by sutures. The wound is left open for subsequent application of

either x-ray or radium, as the case may be (Fig. 1). This condition establishes a condition very similar to and as favorable for treatment as in the superficial growths, and we may expect, therefore, similar results.

Allowing this large area to remain widely open, we may now apply the rays either with the x-ray or by placing radium directly into the bed of the disease. It is now unnecessary to do any material screening, especially when there are large remnants of the diseased tissue left. We have by this procedure eliminated the danger of skin burns and may with safety place radium in direct contact with the tissues which we wish to destroy. Screening becomes necessary only when we have large blood vessels, vital organs or nerves in close proximity to the open wound. The dosage of radiation employed may now be reduced to one-tenth the quantity which would have been required if the applications were made through the skin, for the reasons already mentioned.

It is easy to comprehend why the toxemia should not appear when this form of treatment is employed: *First*, we can usually remove with the knife the greater part if not all of the growth

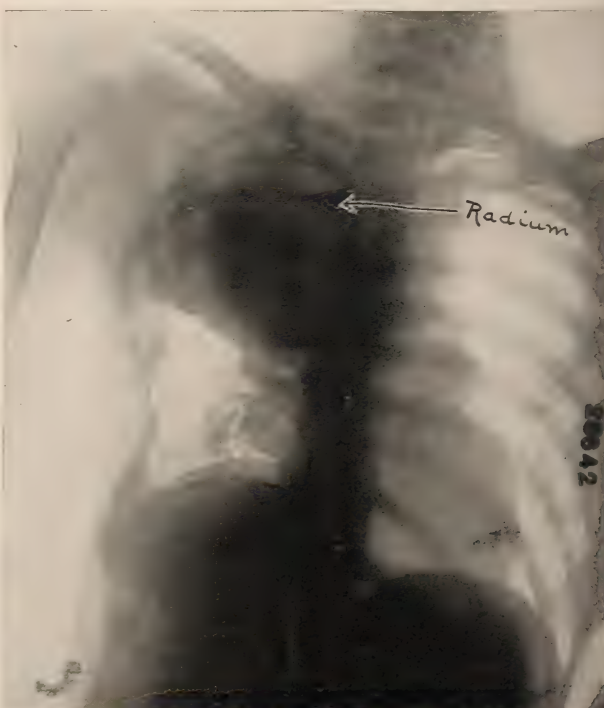


Figure VI.—Recurrence in right apex.



Figure VII.—Exposed lung cavity, showing beginning of new growth.



Figure VIII.—Malignant ovarian cyst.



Figure IX.—Application of radium through funnel shaped crater into the interior of the cyst cavity subsequent to operation.

which in itself takes away one of the main sources of the toxic products. Secondly, in treating this open field or cancer bed with the radio-active agents, we need not apply nearly the dosage which would be required if the overlying tissues (often three or four inches in thickness), were covering the tumor mass. Thirdly, whatever decomposition takes place as a result of radiation in the crater of the wound, is now drained into the dressings instead of being taken up into the circulation. These are three important factors, each of which alone might prevent the toxemia; but combined, in my experience, they have almost eliminated the danger of the poisoning in question.

I cite here only three cases to illustrate the method employed and trust it will appeal to the reader sufficiently to recommend it to the patient in suitable cases. The objection to this procedure is, of course, the operation. Patients dread to be operated, it is true; but they likewise dread a toxemia and they have a better chance to get well if the radiotherapy is doing what is claimed for it.

CASE I.—Sarcoma of the Right Lung
—Removal of Interior of Tumor;
Subsequent Radium Therapy Within the Cavity.

Patient was referred to me on September 28, 1920, with the following history:

She was then 23 years of age, unmarried, and her best weight was 126; present weight, 124. Examination of sputum revealed no tubercle bacilli. Wassermann negative; complete fixation for tuberculosis negative. Afternoon temperature 99.1°. Physical examination showed a few moist rales over the right hilus in front and back

with no change in the percussion note. There was slight enlargement of the thyroid. The stereoscopic x-ray examination of the chest showed a well defined, clean-cut hilus shadow in the center of which was another round shadow about the size of a twenty-five cent piece. It was so round in shape and abrupt in its outer margin as to attract attention. It was not typical of tuberculosis or of anything which involved the lung tissue proper. In three weeks the fever and sputum had disappeared, and the patient resumed her work as a nurse.

On September 10, 1920, the patient had another attack, cough and some hemoptysis followed by bloody sputum for several days and an elevation in temperature. During this time the pupils were dilated. The physical signs were more definite over the right lung, and the x-ray showed that the tumescence had increased and was as big as a grapefruit (Fig. 2). Present weight 116.

October 15, 1920. *Primary operation* (under general anaesthesia): A skinflap including muscles and fat seven inches in diameter was raised. Six inches of each of the fifth, sixth and seventh ribs were resected, exposing the pleura over the tumor mass. The exposed pleura was then cauterized with silver nitrate stick to produce adhesions between the tumor and the pleura.

October 18, 1920. *Secondary Operation*: The wound was exposed and a pursestring suture placed in the centre of it to insure quick closure in case there should be uncontrollable hemorrhage. The tumor wall was then incised; the capsule was rather firm but the interior of the tumor was composed of a semi-solid brainlike tissue, somewhat more solid, but not homogeneous, with more solid portions than softer

portions. It was possible to evacuate the contents in a manner similar to delivering an adherent placenta. The cavity was quickly packed with twelve soft gauze sponges. Patient left the operating room in good condition.

After Treatment: Forty-eight hours later the twelve soft gauze sponges were removed under anaesthesia. There was no hemorrhage. We removed another four or five ounces of the tumor mass from certain recesses of the enveloping capsule. The cavity was repacked. One week after the operation fifty milligrams of radium were introduced into the cavity in the centre of a rubber ball, giving six hundred milligram radium hours (Fig. 3). The wound was dressed daily and the following dose of radium was introduced on the following dates:

October 28, 1920...	600 mgr. hours
November 8, 1920...	425 mgr. hours
November 18, 1920...	450 mgr. hours
December 13, 1920...	400 mgr. hours
December 22, 1920...	300 mgr. hours
January 14, 1921...	450 mgr. hours

This dosage would appear small if the radium were heavily screened. Without much screening the dosage actually delivered is many times what the figures would indicate.

The patient continues to improve and the cavity has shrunk to one-twentieth its previous size. There are some small necrotic masses resembling degenerated sarcoma. The bronchial opening is still present, and when the patient inhales there is a discharge of a serous mucoid substance.

Stereorontgenograms taken (Fig. 4) four weeks after the operation show only a small remnant of the tumor mass, and the tumor-wall very thin.



Figure X.—Epithelioma of the lower lip involving the glands of the neck.



Figure XI.—Introduction of radium into the open wound and beneath the skin.



Figure XII.—Section of upper lip prepared for later plastic operation.

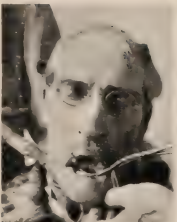


Figure XIII.—Cross-fire application of radium.



Figure XIV.—Illustrating the patency of the mouth.

Pathological Report: The microscopic section of the tumor showed a spindle-cell sarcoma (Fig. 5).

After one year another roentgenogram was taken and it showed recurrence in the right apex (Figs. 6 and 7). The patient, however, appeared in good health, although she had pain in that region. In the roentgenogram we note three radium needles embedded in the tumor; they represent thirty-seven and one-half milligram radium hours embedded without screening directly into the tumor. They were left in for ten hours. The reaction from this relatively small amount of radiation was, to our surprise, very marked. The patient developed fever and had all symptoms of toxemia within a few days after the treatment. The symptoms began to be alarming and large doses of morphine had to be employed to stop the pain.

November 25th I decided to enter this cavity by means of a cautery. I made a large opening into the tumor, through which I introduced my finger, and scooped out a part of the contents of the cavity, tightly packing with gauze to stop the hemorrhage. The patient felt much relieved immediately after she came out of the anaesthetic. One hundred milligrams of radium were inserted into this cavity in the same way in which it was done after the first operation a year ago. This time it was left in for fourteen hours. There was but one millimeter of silver capsule screening.

When we compute the amount of actual radiation issued and absorbed by the tissues when the radium is applied in this manner, namely within the cavity, the total amount actually absorbed is much greater than it would appear.

We have figured that the amount was at least ten times as large as it was at the time when three needles (thirty-seven and one-half milligrams) of radium were introduced into the tumor some weeks previously. Nevertheless the large dosage did not produce any toxemia while the introduc-

tion of the thirty-seven and one-half milligrams of radium into the tumor produced a heavy toxemia.

The reason for this is very clear. The products of decomposition could in the latter application escape freely through the large opening in the cavity while the introduction of the needles into the center of the tumor gave no chance for escape of the products of decomposition, and the same had to be absorbed and circulated through the blood before they could be eliminated.

CASE II.—*Malignant Ovarian Cyst (Cyst Adenoma) Treated by Open Method.*

Mrs. E. S., 66 years old, entered the hospital March 10, 1919. Since December, 1918, she had noticed that her abdomen had grown to a very large size. She lost control of her bladder and lost considerably in weight. Her legs were swollen up to her knees. The diagnosis had already been made by her physician of a malignant ovarian cyst.

An exploration was made, the diagnosis was confirmed, and the case was considered inoperable. There was some fluid in the abdomen and intestines, and the enormous tumor was matted with intestines and studded with small growths resembling papillomata.

The abdomen was closed. She received x-ray treatment for six months, which did not benefit her, for no effect was produced. The abdomen grew larger and larger until she could hardly breathe (Fig. 8). In her desperation she insisted upon an operation, and the same was performed November 15, 1919, as follows: Median incision from the ensiform cartilage to the pubes to deliver the tumor out of the abdomen. The loops of the intestines were firmly adherent to the base of the tumor.

The tumor itself was firmly attached to the entire pelvis and thus was not removable in its entirety. The cyst was, therefore, opened and its contents, a gelatinous mass, removed (about five quarts in quantity).

The upper two-thirds of the tumor was then amputated. The wall of the tumor was two or three inches thick in certain portions and thinner in other parts. The edges of the skin were sutured to the rim of the amputated cyst and the cavity packed with gauze so that there was a funnel-shaped cavity reaching the lowest part of the pelvis.

The interior of the cyst was then treated by direct application of radium at intervals of three weeks—seven hundred to eight hundred milligram radium hours being given each time. The radium treatments were supplemented with deep therapy, one erythema dose being given every second day.

The cavity gradually diminished in size by contraction of its walls and absorption of the tumor, and the patient gained in general health and strength.

The abdominal opening into the cyst remained open for sixteen weeks in a suppurating condition, but finally closed, remaining so up to date—nearly a year and a half after the operation.

The patient is now attending to her daily housework, and has been able to take care of a very sick husband for nearly four months.

Fig. 9 shows introduction of radium into the cavity by curved applicator. Comments:

(a) By eversion of the interior of a malignant cyst, we transformed an intra-abdominal into an external abdominal tumor, and thus were able to apply x-ray and radium directly into the seat of the malignancy.

(b) It is safer to treat the tumor in this manner compared to the attempt of complete enucleation.

(c) It is preferable to treat with radium combined with x-ray than either alone.

CASE III.—*Epithelioma of Lower Lip With Involvement of the Glands of the Neck.*

Patient, fifty-three years of age, presents a large ulcerated growth involving the entire lower lip including

the angles of the mouth. He is unable to retain the saliva and has difficulty in eating. The right submaxillary gland is the size of a hen's egg. Patient lost considerable in weight and strength.

Past History: The ulcer first appeared a year ago, in the region of the mucocutaneous border, and gradually grew to the present size (Fig. 10). It was first diagnosed as syphilis, although the Wassermann was negative. An extensive anti-syphilitic treatment produced no results.

Treatment: Operation August 13, 1920. Excision of the entire lower lip and both angles of the mouth, and that part of the right cheek containing the nodule with a good margin of normal tissue. The incision was then carried to the neck and exposed the region of the gland involvement. The entire area was thoroughly exposed and all glands removed. A suture was made from the angle of the lip to within one inch of the lowest point of neck incision (Fig. 11). Rubber drain was introduced to leave the channel for radium introduction. No attempt was made to reconstruct the lower lip, at this time. It will be noted that we left the entire surface open and exposed to facilitate application of radium and bring direct action on same in cancer bed.

Radium treatment was begun a week after operation. A tube of fifty milligrams was inserted for four hours into the lower lip wound and twenty-five milligrams into the channel left in the lower border of the wound in the neck. Application of same dosage was repeated three times at intervals of two weeks—a total of one thousand four hundred milligram radium hours. The region of the neck was treated weekly with x-ray exposures of four minutes and spark gap of eight inches at intervals of three days.

In Fig. 12 we note the provision that was made for later plastic operation. A section each side from the upper lip each about one-half inch long was prepared to cover the defect in the lower. No suturing was done, the two nipple like portions being allowed to drop down towards the raw surface of the lower lip.

In Fig. 13 we demonstrate the application of radium in the recess of the gingiva.

In Fig. 14 a complete healing has taken place. The border of the mucous membrane from the gingiva has joined the border of the skin of the wound edges of the chin. The patient is able to open his mouth widely.

Such surgical procedure must of necessity often be very extensive and therefore connected with some risk. A half way procedure will not do in such cases. It was a surprise to us, however, to find that the immediate mortality was not as large as one would expect. It is not necessary, however, to describe the technique because this varies in each case and the illustrations which accompany the case reports are sufficient to give this information. If the principle appeals to the trained surgeon he will be able to devise his own plan in each case.

I have carried out this procedure in more than one hundred cases, in a group which usually carries with it a one hundred per cent mortality, in other words, recurrent cancer, or cases so far advanced as to be regarded as inoperable. I have not had a fatal case from toxemia in the past two years, while in the previous three years four of our patients succumbed to toxic symptoms. I have made several reports of this work^(5, 6, 7) with citation of cases il-

lustrating the surgical technique and radiation.

I trust that this small contribution toward the prevention of toxemia, will stimulate others to work it out further as it will be the means of extending the use of radiotherapy to a class of cases in which previously it was not even attempted.

In conclusion I will say that while we have saved only a limited number of this group of cases, many of them were made a great deal more comfortable while they lived. We feel, however, that we have done harm to none and have benefited a few. We attribute the possibility of carrying out this procedure, mainly, to the prevention of toxemia.

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Teamwork Between the Roentgenologist and the Pathologist

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IT IS often worth while to pause in our frenzied search for new things and examine the fundamentals of our chosen field, scrutinize its limitations, criticize its accomplishments and, in short, set our own house in order. The need for such a procedure is especially emphasized in the various specialties which make up the practice of medicine. Such a review, however, must be undertaken by those who are within the particular group under examination and pathology has so many troubles of its own that one of its disciples could ill assume the role of an investigator of other and equally independent fields.

The desirability of establishing more securely the fundamental aspects of any medical specialty is, nevertheless, a dominant one and it is my purpose to review in some of their main features the points of contact which may be maintained between the specialties of roentgenology and pathology. This task is undertaken not because there is any indication that roentgenologists in any way lack a strong interest in promoting the advancement of the scientific aspects of their practice, but because I am certain of your desire to seize every possible opportunity to further the ideals of our common interests, namely the protection of life and health by the most efficient methods.

My interest in the possibilities of co-operative team play was first aroused by some work which was undertaken in 1906, under the direction of that distinguished and beloved veteran of our profession, Dr. Francis H. Williams, of Boston. Together we carried out a series of roentgen-ray exposures on the chests of bodies which were to be examined later and carefully correlated the readings of the plates and the actual results of the gross and microscopic examinations. So many valuable results were obtained by this method that further extensions were planned, but these were interrupted by my leaving Boston for work in the Middle West. Many years elapsed before the subject again assumed, as it seems to me, even greater importance.

When the epidemic of influenza attacked our soldiers in France, it soon became apparent there, as no doubt it did later in this country, that our best clinicians were very greatly embarrassed in their efforts to arrive at accu-

rate conclusions as to the exact conditions in individual chests. Old time methods of physical diagnosis embodied under the terms inspection, percussion, and auscultation (with a due modicum of imagination) proved woefully inadequate in the presence of the insidious plague which was so ruthlessly decimating our forces. These failures often resulted in sending to the morgue the bodies of soldiers whose death was attributed to lobar pneumonia when as a matter of fact the postmortem examination revealed frank empyema, a condition in which active interference, which always promises some hope of relief, had been denied. This denial was the direct consequence of wrong diagnosis and the wrong diagnosis was not always because due care or even professional skill had not been exercised, but because the inaccuracy of the older methods, unaided, was revealed on a scale such as perhaps has never before been reached.

The necessity for aspiration of all chests presenting respiratory diseases, or, better, for calling in the aid of the roentgenologist soon became apparent and the utilization of the roentgenogram in acute conditions of the chest became as routine and needful in making a proper diagnosis, as it had formerly been in the more chronic conditions. Portable apparatus was taken into the wards and soon became a most efficient adjunct to the diagnostic measures used by the more progressive of our medical officers.

Here again a further difficulty was presented which also directed attention to the inherent limitations of medical science which not only demands that all the lore of the past be mastered but that room be left in every field for the acquisition of new facts. In the influenza epidemic we were dealing with an almost entirely new entity and the interpretation of the clinical and roentgen-ray findings presented new problems, which had to be solved and mastered, in addition to the thousand and one complications presented by former diseases. When, therefore, in the hospitals in which I was working, it was proposed that careful comparisons be made of both antemortem and postmortem plates with the actual pathologic conditions presented at the autopsy, the most enthusiastic co-operation was secured. Almost daily conferences and discussions were held in which the lessons learned at postmortem were transferred by the clinicians and

roentgen-ray workers to the wards and more painstaking and, let me emphasize it, life-saving work was accomplished. Our army roentgenologists were willing and anxious to co-operate. Indeed, the whole story can never be adequately told of the accomplishments of this group of men who worked under the most discouraging conditions, with lack of equipment, lack of trained assistants, lack of suitable quarters and, worst of all, lack of that atmosphere of hearty appreciation of needs and deeds without which the modern medical man can hardly be happy in his work. I cannot resist this small appreciation of the magnificent spirit and the splendid results produced by the workers in this important field of our army medical life.

The transfer of these methods, so fruitful in results, to the diagnosis of other conditions equally troublesome from the diagnostic standpoint became a matter of course. In the early months of the epidemic sinus troubles were prominent both because of their severity and the menace they held for the production of serious complications. Again, clinical methods were often at fault in the attempt accurately to estimate the nature of the disease processes. Empyemas of sphenoids, frontals and antra were allowed to go unrecognized and the patient's comfort and, perhaps, even life itself were jeopardized. The sinus conditions presented by the epidemic, like those found in the respiratory tract, were so acute and fulminating as almost to constitute a class by themselves. Routine procedures in exposing and interpreting plates were many times proved to be insufficient. Only after careful review of the results of the postmortem with the plates studied by the side of the dead body were our clinicians aware of the difficulties of diagnosis and the seriousness of the lesions revealed by the plates with almost startling accuracy.

One cannot overestimate the by-products of such co-operative activities. The increased training which extended to the entire staff, including the pathologist, the stimulation to early recognition and proper treatment of disease processes, the spirit of team work with the patient's ultimate welfare as the goal, all this developed an *esprit de corps* which is as difficult to produce as it is to describe.

The foregoing examples, taken from actual experience, only serve to hint at

*—Read before The Radiological Society of North America, Chicago, December 10, 1921.

the almost limitless possibilities presented by this sort of combined efforts. Hardly any other method presents so many possibilities of gaining new knowledge, additional skill in interpretation or increased confidence of judgment. So vast and complicated has the science and practice of roentgenology become that even now specialists in this field often devote the major portion of their energies to particular anatomic divisions of the body and acquire special expertise in the diagnosis of conditions of the head, chest, gastro-intestinal or genito-urinary tracts. Such special skill presupposes the most accurate and painstaking knowledge of both the anatomy and pathology of the regions studied. How can such training be more readily obtained than by frequent attendance at the postmortem examination, preferably with the plate which has been interpreted during the life of the patient?

In the head, important factors such as the effects of angulation, the variations in penetration produced by changes in technique as well as the pathologic changes in bone and soft tissues, the proper interpretation of pathologic conditions of the sella turcica, the diagnosis of brain tumors and hemorrhages and correct methods of best revealing the multitude of diseases to which the bony sinuses are exposed, all such points and many others are illuminated and clarified by repeated comparisons between the apparent, which is on the plate, and the real, which is in the head itself.

Diseases of the chest present such a complex picture with the almost unlimited possibilities of various combinations of diseases, that the clinical determination of the exact pathologic syndrome which may be presented by the chest of the average adult, is often not only a difficult but even an impossible task. The fact, of course, has been appreciated by the roentgenologists, who with others of the medical profession have labored under the difficulty of inaccurate knowledge with regard to the causes and sequence of disease processes. In both the clinical and roentgenologic fields, over-confident observers have given wrong diagnoses because their judgment was based on insufficient knowledge or experience and thus have thrown disrepute on all branches of the profession.

If a chest at one and the same time may present both fibrous and calcareous plaques in the pleural linings with or without collections of fluid of varying densities, old calcareous masses in the lungs as the remains of tuberculosis in infancy, calcareous changes in the cartilaginous rings of the large bronchi,

caseation and calcareous deposits in the lymph nodes around the bronchi, old tuberculous foci at the apices with adhesions and distortion of the lung pulp, dilated bronchi containing dense exudate, emphysema, pneumothorax, atelectasis, infarcts, congestion and edema, to say nothing of tumor nodules of various kinds in the mediastinum and the lungs, with the further conflicting factor of aneurism, then the accurate interpretation of the shadows of these conditions, the separation of the old and finished processes from those that are advancing, the evaluation of the importance of the suggested lesions, demands skill and experience which reaches the height of medical attainment. I am quite ready to defend the thesis that such heights are impossible of successful achievement without the most painstaking collaboration between the pathologists and those who are caring for the patient during life. It is indeed doubtful, whether long and continued experience in the interpretation of plates under the tutelage of masters can be completely substituted for the experience which may be gained from the autopsy, where new methods may be tried out and variations made in experimental work which will help to solve the many problems presented in both technique and diagnosis.

Perhaps the most important disease of the chest and one of which we are constantly reminded is tuberculosis. This disease, by the protean character of its manifestations and the insidious non-symptomatic nature of many of its processes, gives rise to more practical difficulties of exact interpretation than almost any disease with which we have to deal. It was the postmortem examination which taught us the significance and almost universal occurrence of the early lesions of infancy, and the changes which were produced by those lesions in the lymph nodes and pleural surfaces of the lungs. Many misconceptions still remain for clarification with respect to the pathogenesis of the acquired lesions in adult life and the final word has not been spoken with regard to the difference in reaction between the partially immunized and the wholly unprotected tissues of the human body.

Objection has been made that at necropsy only the end results are presented and that none but the pathologist can have any very vital interest in these terminal lesions; the patient is dead, and, by that same token, clinical interest must cease. This is founded on a most superficial and mistaken conception. Patients die from myriads of causes and in a series of routine post-mortem examinations will present not

only terminal lesions but the beginning phenomena of disease in every organ and region of the body. Indeed the autopsy is almost our only source for acquiring information of the vast array of pathologic conditions which I have been accustomed to group under the term "subsymptomatic" pathology. This includes not only those lesions which may never develop to a stage where any appreciable signs or symptoms will be present, but also the early stages of all the major complaints to which the human body is subject. We often fail to appreciate the extent, both in time and in tissue alteration, which these processes may reach before the patient applies to our profession for relief. For the earlier detection of such, the roentgen ray has become indispensable. How can their significance be properly estimated, however, without exact knowledge of the etiology, developmental courses and tissue changes possessed by these diseases from their insignificant beginnings to their life-menacing ends. Routine roentgenographic pictures of various regions taken at different intervals and studied in the light of what may be revealed at the autopsy would furnish one of the most sound bases possible for the founding of our knowledge and the improvement of our skill.

To a much less degree, the methods which have been indicated apply in the study of the lesions affecting the gastro-intestinal tract. This field represents some of the most brilliant achievements of roentgenology, but even here there remain open numerous questions, not only with regard to pathogenesis but with respect to the development of disease. Such a simple subject as the physiology of peristalsis is still far from clear and there is little wonder that disturbances of this function should lead to many mistaken diagnoses, and, what is more important, errors in treatment.

The exposure of the lesions of the gastro-intestinal tract in the operating room is one cause for rapid advancement in our knowledge. However, this exposure cannot be compared with that which may be accomplished at the necropsy, and various roentgenologic studies of the living patient and even of the dead body before the examination, may give rise to most important and far reaching results.

In the development of new methods, the autopsy is on a par with animal experimentation. This is illustrated by the stage which the diagnosis of genito-urinary conditions has reached. The use of various substances in solution or as gases which will afford more detailed information with regard to body

cavities and tubes, has by no means reached a stage of perfection and one of the most valuable methods by which these new substances can be tried out is in conjunction with the work of the pathologist.

In the field of therapy, whether by the roentgen ray or by radium, the pathologist has always been granted an important place. Much of our knowledge concerning the principles of the therapeutic application of these rays, has resulted from painstaking researches on the microscopic appearances of human and animal tissues. In view of the wide differences of opinion in the clinical world with respect to the value and the possible abuses of these powerful rays, to say nothing of our uncertainty with regard to technical methods, it

would seem that there is still further and very important work to be accomplished. More accurate standards are necessary and more careful studies on both operative and postmortem specimens are indicated. The careful collection of large series of data furnishes the only sure basis for fundamental advances.

During the short time in which I have been associated with the Mayo Clinic, most valuable co-operation has been established with the roentgen ray department under the direction of Dr. Carman, who has always proved a ready convert to the usefulness of reviews of postmortem studies. Not only are diagnoses compared and mistaken impressions corrected, but new processes are being investigated and further

extensions are being planned. Routine roentgenograms of special regions of all dead bodies and careful comparison of these plates with those taken during life, on the one hand, and the actual lesions seen, on the other, will afford an incomparable method for educating our younger workers, carrying on special researches and perfecting the skill of both the clinical and laboratory members of our permanent staff.

Teamwork with the pathologist means so much mutual inspiration, such important advancement in the growth of our knowledge, and such honest acquirement of special skill and wisdom, that wherever possible, this form of co-operation should be undertaken to its fullest extent.

Bone Diseases: Non-Suppurating Osteomyelitis (Garre) Infectious Ossifying Periostitis (Bloodgood)

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IN the Journal of Radiology for March, 1920, page 147, in reporting two hundred and forty cases of bone tumors I discussed ossifying periostitis under the following classification:

1. Traumatic Ossifying Periostitis.
2. Syphilitic Ossifying Periostitis.
3. Pyogenic Ossifying Periostitis, associated with osteomyelitis.
4. Ossifying Periostitis about tuberculous lesions of bone.
5. Ossifying Periostitis associated with benign tumors near bone.

I should now like to correct type three and designate it *Infectious Ossifying Periostitis*.

In the two years since this publication the number of bone tumors has increased to almost nine hundred, and the number of cases of infectious ossifying periostitis from one to eight.

Recently Samuel Fosdick Jones, in the Journal of the American Medical Association (77:986, Sept. 24, 1921) in reporting a case somewhat similar to the one I discussed in the Journal of Radiology, called attention to the previous communication of Garre, who called the lesion *non-suppurative sclerosing osteomyelitis*, and gave the literature. I was not familiar with Garre's article until the appearance of the communication by Jones, but a few other cases had been observed and had been grouped together as a clinical, x-ray, and pathological entity under the group name of infectious ossifying periostitis.

That I have observed seven cases of this type since February, 1921, a period of thirteen months, is an indication that it is a bone lesion which we must bear in mind and one that must

be differentiated from periosteal sarcoma when a single bone is involved, and from metastatic carcinoma when two or more bones are involved.

As this is but a preliminary report, I will not go into the details of a discussion of the literature, nor into any theoretical considerations, but simply record the most important factors in the history and in the x-ray picture. One must have a much larger group before one can be quite certain as to the etiological factors and the exact nature of this rare single or multiple and apparently primary periosteal bone lesion.

At the present moment this small group of single and multiple infectious ossifying periostitis shows a striking resemblance to infectious single or multiple arthritis.

We are all familiar with the so-called acute articular rheumatism, a polyarthritides of apparently infectious origin, which rarely, if ever, goes on to suppuration. In many instances there is complete recovery without loss of joint function; in other instances one or more joints are impaired by the unresolved inflammatory exudate. In a second group the primary attack may or may not be acute, but the arthritis of one or more joints persists with repeated exacerbations until there develops the clinical picture of arthritis deformans, which apparently is of two distinct forms: one associated with bone formation, designated as osteoarthritis; the other without new bone formation, often called atrophic arthritis.

We now know that in all of these cases of infectious arthritis, whether one or more joints are involved, if we

can find and remove the focus of infection, further attacks of arthritis do not occur, and the loss of function in the joint or joints remains as it was when the process was arrested, or improves.

It would appear that from a focus of infection we may have a single or multiple involvement of a bone, apparently chiefly a periostitis which does not go on to abscess formation so common in the pyogenic osteomyelitis in children, but may subside spontaneously as in acute articular rheumatism, leaving little or no evidence of the inflammatory process, or, it may persist as a thickening of the bone, or it may, if the focus of infection is not removed, go on to the typical picture of osteitis deformans first described years ago by Paget.

While arthritis deformans in adults is a common observation, Paget's osteitis deformans is rare.

PAGET'S OSTEITIS DEFORMANS

I have a record of but a single case (Pathol., No. 21812-1/2, J.C.B. 5067). This patient was observed in July, 1913, and remains in the same condition in March, 1922—nearly eight years. The lesion involved the tibia and showed the bowing and increased thickening of the cortical layer as described by Paget. The patient was a white male, aged fifty-eight, and the ossifying periostitis of the tibia developed gradually after a contusion. It was of two years duration when I first saw the patient. The Wassermann was negative, antilutetic treatment had no effect; no search was made for foci of infection. The patient still suffers from

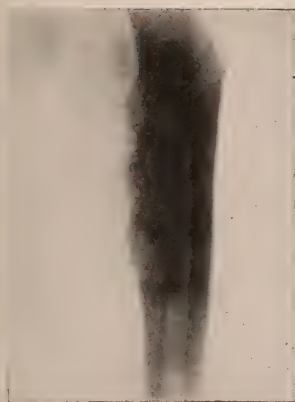


Figure I.—Case I.—Pathol. No. 16865. Infectious ossifying periostitis of shaft of left femur. Focus of infection carbuncle on thigh. Diagnosed periosteal sarcoma in 1914. Refused amputation. Well in 1922.

pain and disability; the size of the tibia has gradually increased; the bowing has increased. This man has received no treatment, and no further investigation since I saw him in 1913.

A TYPICAL CASE OF INFECTIOUS OSSIFYING PERIOSTITIS OF THE GARRE TYPE INVOLVING A SINGLE BONE.

Case 1—(Pathol., No. 16865, J.C.B., 5617)—Olaf Swanson. This patient's case was reported in detail in the *Journal of Radiology*, March, 1920, p. 205 (Figs. 81 and 82, p. 235). The observation is of added interest, because, clinically, from the x-ray and microscopically from a piece excised for diagnosis, it was diagnosed by many as *periosteal sarcoma* of the shaft of the upper third of the femur. The patient, however, refused amputation, or any treatment, and is now well and capable of hard work in March, 1922, eight years after he was first observed by me.

The etiological factor was a boil on the medial side of the lower third of the thigh, the side on which the femur became involved. This boil had been first observed about five months before I saw the patient and had healed in two weeks. Following the healing of the boil the patient was conscious of pain and swelling involving the upper third of the shaft of the femur, and he entered my clinic at St. Agnes Hospital in 1914 because of this pain and this swelling.

I have gone over all of the cases of sarcoma of bone and in not one is there a history of a local infection of this kind on the limb preceding the development of the periosteal sarcoma.



Figure II.—Case I.—Pathol. No. 16865. Infectious ossifying periostitis. See Figure I.

The patient could walk without limp. No other lesion, except that involving the upper end of the femur could be made out. All laboratory examinations, except the x-ray, were negative. Nothing could be seen on inspection. Palpation revealed a spindle swelling surrounding the shaft of the upper end of the femur beginning at the great trochanter and most marked on the medial side. This spindle swelling was much larger than the area of bone formation shown in the x-ray (Figs. 1 and 2).

When we have a spindle swelling of a long pipe bone, which does palpate like bone and which cannot be explained by the shadow of bone formation in the x-ray, it is very suggestive of periosteal sarcoma. But, as pointed out in the *Journal of Radiology* in March, 1920, such spindle swellings have been observed in syphilitic ossifying periostitis and this type of infectious ossifying periostitis; but, in my experience, not in traumatic ossifying periostitis, at least, in the later stages of the disease.

X-rays. (Figs. 1 and 2). These were interpreted in 1914 as periosteal sarcoma, and they have been shown to many colleagues since who made the same diagnosis, but recently in Chicago when I threw the lantern slide on the screen and requested opinion from the roentgenologists in the audience, two made the correct diagnosis of either syphilitic or infectious ossifying periostitis. In these pictures the outer zone of bone has the hazy, cloudy appearance common in periosteal sarcoma, but the next irregular zone of bone resting on the cortical layer is of a density unusual in sarcoma. Nevertheless, I have cases of proved periosteal sarcoma in which this dense layer of



Figure III.—Case I.—Pathol. No. 16865. Infectious ossifying periostitis. Result two years after Figures I. and II.

periosteal bone is present. In this case under discussion the cortical bone showed areas of destruction, but this may be observed in syphilitic periostitis, and we now know, it may be present in infectious periostitis. The shadow of the marrow cavity is much more distinct than is usual in sarcoma, because in periosteal sarcoma there is rapid involvement of the shaft beneath by infiltration through the Haversian system, and this infiltration produces definite reactions in the cancellous bone and marrow cavity, and changes the entire architecture of the area of involved bone, and this change shows distinctly in the x-ray. See the *Journal*, March, 1920, p. 229 (Figs. 62, 63 and 64).

The patient left my clinic at St. Agnes, because amputation was suggested, and entered another hospital, where a piece was excised for diagnosis. The operator found, first, a fairly distinct capsule, a zone of tissue containing no bone, and then a zone of tissue containing new bone.

Microscopic Picture. Fig. 4 (low power) shows the two zones—one with bone and one without. Fig. 5 is a high power photomicrograph of the very cellular tissue. These sections were then interpreted, and frequently since, as sarcoma.

Result. Fig. 3 is an x-ray about two years after the exploratory incision. A recent x-ray, eight years after observation, has not yet been made.

Remarks. I believe this observation corresponds to the cases described by Garre as non-suppurating sclerosing osteomyelitis, and the case recently described by Jones.

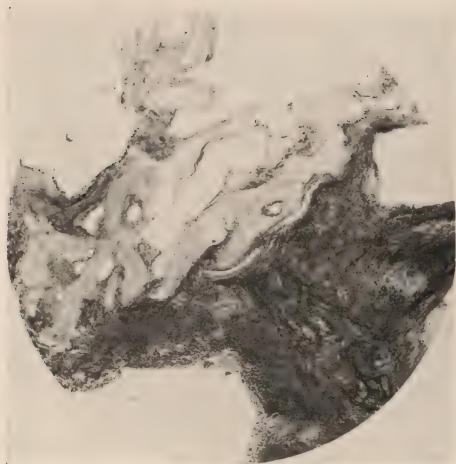


Figure IV.—Case I.—Pathol. No. 16865. Microscopic picture (low power) from piece excised for diagnosis.

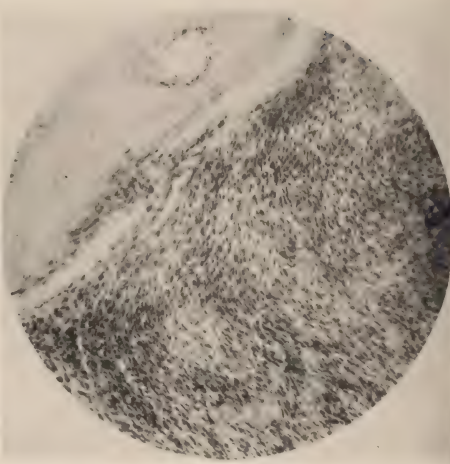


Figure V.—Case I.—Pathol. No. 16865. Microscopic picture (high power) from piece excised for diagnosis.

Complete resolution took place in the case observed by me, because the focus of infection (the carbuncle) healed spontaneously. If it had not healed, it is possible that the lesion in this individual would have continued and developed the picture of osteitis deformans of the femur as described by Paget, similar to the first case involving the tibia, reported here.

OTHER CASES OF INFECTIOUS OSSIFYING PERIOSTITIS OF THE GARRE TYPE INVOLVING A SINGLE BONE.

Case 2—(Pathol., No. 28771, J.C.B., 10894)—This case was first observed in September, 1921. The patient, J.E.D., was referred to me by Dr. Walter A. Ostendorf, of San Antonio, Texas.

The x-rays showed that the upper end of the femur, trochanter and neck, is involved. Fig. 6 illustrates an ossifying periostitis which almost excludes sarcoma. The new periosteal bone involving the shaft suggests an old affair. About the neck above and below there are dark areas suggesting new bone formation or calcification, as I have seen frequently in tuberculosis. There is also an area of new bone formation from the pelvis just above the rim of the acetabulum. The x-ray picture suggested to me a lesion of long duration—either syphilis, tuberculosis, or infectious ossifying periostitis. Fig. 7 is another view. The bone formation here on the shaft is not unlike periosteal sarcoma, but the marrow shadow is against sarcoma.

Periosteal sarcoma in this region of the femur involving the neck is very

rare. I have pictured a typical case in the *Journal of Radiology*, March, 1920, p. 230 (Figs. 65 and 66).

Clinical History. Although the x-ray suggested a bone lesion of many months duration, there have been no symptoms except for three months, and the symptom of onset was unusual. While swimming, this patient kicked out, experienced a sudden pain in the left hip which lasted for ten minutes; the hip was sore for three days. One month later, on stepping out of an automobile, the sudden pain in the hip was so intense that he fainted, but later was able to get into the automobile. There was residual soreness for two days. Then the patient began to limp and used a cane, mostly because of the fear of another attack of this pain. One month and again four days before I examined him, there had been a short, acute attack of pain of less intensity. The patient had never been conscious of any restriction of motion, nor has he ever felt a swelling.

Examination. Nothing could be seen on inspection. On palpation in the region of the upper third and trochanter, the bone seemed thicker and rougher. There was practically no restriction of motion and very little tenderness. All laboratory examinations were negative, except for pus in the urine and a slight urethral discharge in which no gonococci could be found. X-rays of other bones, teeth and sinuses negative.

Etiological Factor. The patient gives a history of repeated attacks of gonorrhea without complications between fifteen years and two months

ago. In one attack he remembers pain in the shoulder. The patient, therefore, has had a gonorrheal infection for many years.

He was given, as a matter of precaution, intravenous salvarsan and local treatment for the urethral discharge until it disappeared.

Remarks. We know that gonorrhea may produce a single or multiple arthritis even up to complete joint destruction, and I have observed fully developed and typical polyarthritis deformans from gonorrheal infection. In a few instances I have observed a gonorrheal arthritis extend to the neighboring bone and produce typical osteomyelitis. In this instance, apparently, a gonorrheal infection had given rise to an ossifying periostitis of such an insidious character that there were no symptoms until three months before the x-rays were taken. The clinical picture was that of a "snapping" or locking hip and could be easily explained by some motion in the hip-joint beyond the usual degree which impinged upon an area of new bone formation.

Result. (March, 1922, six months since observation). As the patient has walked with a cane and has avoided all extreme motions in the hip, there have been no further attacks of pain, but he is conscious of discomfort. A recent x-ray has been taken, but has not yet been received here.

I have reviewed all my cases of gonorrheal infection of joints and bones of which I have x-rays—some fifty cases in all—and find nothing identical with this. I do find ossifying



Figure VI.—Case II.—Pathol. No. 28771. Infectious ossifying periostitis associated with gonorrhoea.

periostitis in conjunction with gonorrhoeal arthritis, but none with an uninvolved joint as in this instance.

Case 3—(Pathol., No. 29084, J.C.B. 10978). First observed October 29, 1921. This patient, Dr. L.A.W., was not seen by me, but his history and x-ray were referred to me by Dr. Walter A. Calihan of Rochester, N. Y. It is an infectious ossifying periostitis of the upper shaft of the femur not involving the neck, and apparently due to foci of the infection in the teeth. Fig. 8 is the x-ray. As compared with Fig. 6 it shows chiefly thickening of the cortical bone beginning at both trochanters and extending down the shaft. This thickening shows both, dark and light areas. The marrow shadow is but slightly changed. There is no marked evidence of recent bone formation. It suggests an old affair.



Figure IX.—Case IV.—Pathol. No. 29153. Infectious ossifying periostitis, healed, in quiescent stage. Foci of infection not ascertained.



Figure VII.—Case II.—Pathol. No. 28771. Infectious ossifying periostitis associated with gonorrhoea.

Clinical History. The patient is a white male, aged fifty-six. He has had lumbago for years. Three months before the x-rays were taken, he began to have pain in the left knee and thigh, worse at night. This has continued since.

Examination. The x-rays of the teeth show infected root abscesses, the tonsils are infected; the blood pressure is 110-80; other laboratory examinations negative. Dr. Calihan and his colleagues were rather of the opinion that it was not sarcoma, but chronic osteomyelitis. No note was sent to me on the palpation of the involved area of the femur, nor on joint motion. I concurred in their diagnosis and advised extraction of the teeth and removal of the tonsils.

Case 4—(Pathol. No. 29153, J.C.B. 11058)—This patient's history (Miss J. B.) and x-ray were referred



Figure X.—Case V.—Pathol. No. 29391. Infectious ossifying periostitis, in healed stage. Focus of infection in finger.

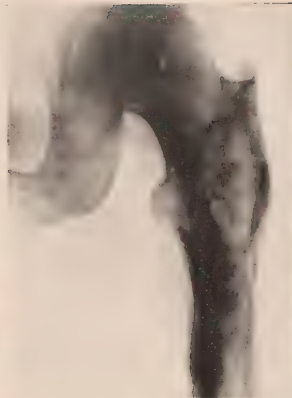


Figure VIII.—Case III.—Pathol. No. 29084. Infectious ossifying periostitis associated with root abscesses of teeth.

to me by Dr. E. L. Kiesel of Scranton, Pa., in November, 1921. The ossifying periostitis involved the upper third of the shaft of the femur, and suggests the healing or healed stage.

X-ray—(Fig. 9)—This practically describes itself. One would not think of periosteal sarcoma. The x-ray picture could easily represent the healed stage of traumatic, syphilitic or infectious ossifying periostitis. The thickening is chiefly on the medial side; the shadow over the marrow cavity is undoubtedly due to cortical thickening and not marrow involvement. It is not the picture observed in sarcoma.

Clinical History—The patient is a white female, aged seventeen, and has complained for one year of pain in the left hip and thigh. The pain is worse at night and relieved by aspirin. The patient is at work as a book-keeper. There has been no fever or loss of weight. The Wassermann is negative, the blood shows slight anemia with a leukocyte count of 5,600. There is no history or evidence of a gonorrheal infection. The x-ray of the chest shows that the excursions of the diaphragm are diminished with a slight shadow in the peribronchial



Figure XI.—Case VI.—Pathol. No. 29019. Multiple infectious ossifying periostitis of femur and tibia. Focus of infection in colon (?). See Figure XII.



Figure XI-a—Case VI.—Pathol. No. 29019. Multiple infectious ossifying periostitis of femur and tibia. X-ray taken four months after that shown in Figure XI.

region in the middle of the hilus of the left lung.

There is no evidence of an infection of the nose and throat, nor of the teeth. The patient remembers a bump on this thigh a month before the pain began.

Result. March, 1922, four months. Dr. Kiesel sent me a second x-ray, which is practically identical with the first (Fig. 9). There is no evidence of any new periosteal bone formation or bone destruction. The patient is just recovering from an attack of bronchopneumonia.

Remarks. This may be an example of traumatic ossifying periostitis, but I am suspicious of a focus of infection somewhere, perhaps in the lungs, on account of the x-ray picture, the low leukocyte count, the slight anemia, and the recent bronchopneumonia. It resembles, in the x-rays, closely the cases reported by Garre and Jones. It is not unlike the x-ray studies of Paget's disease,

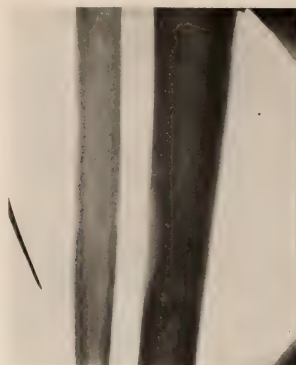


Figure XII—Case VI.—Pathol. No. 29019. Multiple infectious ossifying periostitis. Focus of infection in colon (?). See Figure XI.

except there is no bowing, and the amount of bone formation is moderate.

Dr. Kiesel reports later that the area shown in the x-ray is palpable. He is inclined to the opinion that it is not sarcoma.

Case 5—(Pathol. No. 29391. J.C.B. 11295). The history and x-rays in this case were sent to me in December, 1921, by Dr. H. H. Sherck of Pasadena, California. The lesion involves the shaft of the femur and suggests the healed stage of infectious ossifying periostitis. Dr. Sherck and his colleagues were of the opinion that it was not sarcoma. The x-ray (Fig. 10) was taken November 23, 1921, and does not differ from previous x-rays.

Clinical History. White female, aged forty-eight, unmarried. There is a long history of ill health, of an attack of bronchopneumonia, of gastric symptoms, of scarlet fever, of a chronic

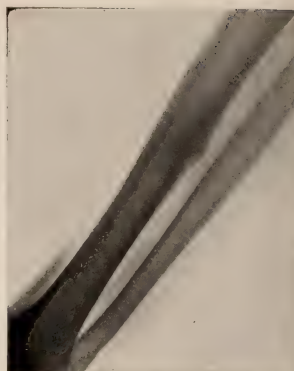


Figure XII-a—Case VI.—Pathol. No. 29019. Multiple infectious ossifying periostitis of femur and tibia. X-ray taken four months after that shown in Figure XII.

skin lesion, of a chronic infection of one finger and of infected teeth. The first x-ray of the femur was taken in 1919 and showed the lesion of the shaft of the femur about as it is in 1921. The patient still has pain in the involved finger which has healed, but the x-ray of the hand shows nothing definite.

MULTIPLE INFECTIOUS OSSIFYING PERIOSTITIS.

Case 6—(Pathol. No. 29019, J.C.B. 10950). First observed in October, 1921. Two small lesions, one in the upper shaft of the femur and one in the shaft of the tibia. Etiological factor not discovered after complete examination.

This patient (F.D.K.) a white male aged sixty-seven, was referred to me by E. F. Root of Salt Lake City. Fig. 11, an x-ray taken October 12, 1921,

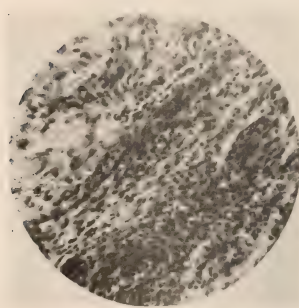


Figure XIII.—Case VI.—Pathol. No. 29019. Multiple infectious ossifying periostitis. Focus of infection in colon (?). Microscopic picture of piece excised from focus in tibia. interpreted as granulation tissue.

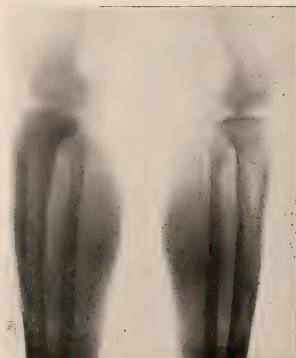


Figure XIV—Case VII.—Pathol. No. 29616. Multiple infectious ossifying periostitis of both bones of both legs and pelvis, most marked on right tibia.



Figure XV.—Case VII.—Pathol. No. 29616. Multiple infectious ossifying periostitis of both bones of both legs and pelvis, most marked on the right tibia.

shows the small lesion on the outer side of the shaft of the femur below the trochanter. There is periosteal bone formation with some cortical destruction and not much change in the marrow cavity. In this area, although there was pain and tenderness, little or nothing could be made out on palpation. Fig. 12, an x-ray taken on the same date, shows a small lesion in the middle third of the shaft of the tibia on the fibula side. Here also there is some periosteal bone formation and cortical destruction, but the marrow shadow is normal.

I have never observed primary periosteal sarcoma to occur as a multiple lesion, nor have I ever observed metastatic bone tumors to appear as periosteal lesions. Therefore, the x-rays in this case suggested that the lesion was of an inflammatory type, traumatic, syphilitic, or what I have called infectious ossifying periostitis. In this case repeated Wassermans were negative and intravenous salvarsan was followed by no improvement.

The onset of the illness began three months before I saw the patient, acutely and without a history of previous illnesses which could be looked upon as etiological factors. This man, in apparently good health, experienced fatigue, weakness, difficulty in using his lower limbs, but no pain. Dr. Root who made a careful examination found albumin and casts in the urine, and there was occult blood in the stools. The patient gradually improved and then began to have pain in the upper third of the right femur and in the middle of the left tibia with some swelling of the left foot when he walked; sleep was disturbed by numbness and discomfort in the lower limbs. X-rays were taken and a provisional diagnosis of sarcoma of the right femur and left tibia suggested.

The patient came under my observation three months after onset, complaining chiefly of pain in the two bone foci. We were unable to get a history of trauma or of any infectious disease. A most thorough and repeated examination was made—everything was negative except blood in the stool which was intermittent. A rectal examination found a few external hemorrhoids, and, on proctoscopic examination, we found one small polypoid mass the size of a split pea which could explain the little blood in the stool. Systematically nose and throat, tonsils, teeth, prostate, seminal vesicles were examined without positive findings. X-ray studies with bismuth were made of the colon with negative results. There was nothing in the clinical history to suggest a lesion of the colon beyond

the small polypoid mass found on the proctoscopic examination. On palpating the two bones in the area of the femur nothing definite was made out, while in the area of the tibia there was infiltration of the tissues on the fibular side.

Dr. Root wrote me that the symptom of onset suggested acute nephritis and later the bone foci became clinically evident by pain and tenderness. X-rays of other bones were negative.

This was my first observation of a lesion of this kind.

Operation, October 15, 1921. Under novocaine I explored the focus in the tibia. The periosteum was a little thickened by inflammatory tissue; there was little new bone formation and some bone destruction of the cortical layer.

The microscopic picture (Fig. 13) was interpreted as inflammation and not sarcoma.

Result. March 22, 1922, five months, Dr. Root writes that the patient looks well and is able to attend to business. He walks on crutches, because the right hip is swollen and painful. This swelling has taken place since he passed from my observation. The wound on the left tibia, which had healed when he left St. Agnes Hospital, broke down, discharged for a short time and healed. This is evidence in favor of an inflammatory lesion and against sarcoma. The patient still observes a little blood in the stool. The urine, however, shows no evidence of albumin or casts. The red and white blood count was normal; the hemoglobin is a little low—sixty-eight per cent; while under my observation it was eighty per cent.

X-rays were taken January 23 and February 13. On January 23 the lesion of the femur as compared with Fig. 12 shows some smoothing down of the irregular periosteal bone formation, but slight increase in the cortical destruction, while the later x-ray of the

same area on February 13, shows an increase of the periosteal bone formation and a beginning involvement of the trochanter above with a new focus in the tuberosity of the ischium.

The changes in the tibia as compared with Fig. 13 on January 23 showed perhaps a slight increase in bone destruction and bone formation, while on February 13th cortical bone destruction had almost reached the marrow cavity. The patient still complained of pain.

Remarks. Apparently in this patient there is no great improvement in the bone lesion, and a third focus has appeared, but it is to be noted that the focus of infection has not yet been found.

I have just been sent the x-rays taken February 19, 1922. Fig. 11-a should be compared with Fig. 11. The difference in time is four months. The lesion below the greater trochanter shows more bone formation; the marrow cavity is not invaded; beneath the new periosteal bone the cortical layer shows destruction. Note the new bone focus on the ischium.

Fig. 12-a should be compared with Fig. 12, four months difference in time. My impression is that the lesion on the tibia which I explored is healing. The new bone is more condensed, the cortical layer has been almost completely restored; the marrow cavity is not involved.

MULTIPLE INFECTIOUS OSSIFYING PERIOSTITIS.

Case 7—(Pathol. No. 29616. J.C.B. 11452)—This patient (W.J.C.) came under my observation February 11, 1922, with E. W. Grier of Elizabeth, N. J., who had carefully studied the case. His chief complaint was pain and swelling of the upper third of the right leg. The swelling disappears after rest in bed. The pain keeps him awake at night. He walks without a limp. On palpation there is thickening of the upper half of the right tibia with distinct bowing. X-ray studies, however, found involvement of both bones of both legs and the pelvis.

X-ray Studies. Fig. 14, a lateral view, shows that the right tibia is bowed and there is thickening of the cortical layer. This is the picture usually seen in syphilitic periostitis or in the early stage of Paget's disease. It is not unlike the x-rays reproduced by Jones. Yet, this picture shows that the fibula on the same side, and both bones of the other leg, show here and there new bone formation and definite thickening of the cortical layer without change in the marrow shadow. Fig. 15 is an anteroposterior view of the bones of the leg and shows changes similar to those in



Figure XVI.—Case VII.—Pathol. No. 29616. Multiple infectious ossifying periostitis of both bones of both legs and pelvis, most marked on the right tibia.

Fig. 14. Fig. 16 demonstrates that the femora are uninvolved, but there is distinct evidence of an ossifying periostitis of the pelvis, chiefly of the ischium and the pubic bones. No other bones showed evidence of involvement. Palpation was negative except for the thickening and bowing of the right tibia.

Clinical History. This patient, aged sixty-four, was apparently well until November, 1921, two and one-half months ago. He was taken with a sudden collapse. Dr. Grier found him in bed, the heart action was rapid and irregular, but there was no fever and no other definite symptoms. From this attack there was apparent recovery and he returned to work. Then, in a few weeks, he observed pain in the right tibia. The pain was intermittent and radiated to the ankle. Then he observed swelling of the edematous type which disappeared after rest in bed. Then there was slight bowing of the tibia and on examination increase in the thickness of the upper third of the shaft of the tibia.

Examination. Wassermann negative. Blood practically normal. Urine contains a trace of albumin. Slight increase of blood urea and blood sugar. A faint systolic heart murmur geared at the apex and transmitted to the axilla. No enlargement of the heart on percussion or in the x-ray. Teeth show evidence of root abscesses. Tonsils infected; nasal septum deflected to the right; sinuses cloudy.

The patient returned home, was given salvarsan without relief, and some of the teeth were extracted.

Second Examination. February 11, 1922. No change. Swelling of the

right leg disappears after rest in bed. Pain is better when he remains quiet. No fever, no leukocytosis. X-ray shows no change in the bones of the leg. Apparent improvement in the pelvic bones. General condition good. Dr. Grier was advised to have the affected teeth extracted, the tonsils removed, the deflected septum repaired and the sinuses drained.

Remarks. These two cases of multiple infectious ossifying periostitis are not unlike multiple osteomyelitis in children, except the lesions have not gone on to suppuration. In both there is a history of an acute attack, however, without fever or leukocytosis; in one cardiac symptoms predominated, in the other there were signs of nephritis.

INFECTIOUS OSSIFYING PERIOSTITIS OF THE BONES OF THE SKULL.

Case 8—(Pathol. No. 29831, J.C.B. 11021. This patient (Mrs. C.T.) was brought under my observation by Dr. S. Ginsberg of New York, with a complete history and a most thorough examination March 25, 1922.

The most striking feature is the involvement of the entire bones of the skull with no apparent involvement of the bones of the face or skeleton, and multiple root abscesses. Since the recent extraction of many of the infected teeth, there has begun to be improvement.

X-ray Studies. Fig. 17 and Fig. 18 show an antero-posterior and a lateral view of the skull. The predominant picture is ossifying periostitis of the ex-

ternal table, thickening of the skull bone with possibly a small exostosis on the inner table of the occipital bone; the facial bones are not involved; the sinuses are free; the remaining teeth show no positive evidence of root abscess.

I have a number of cases of primary sarcoma and metastatic carcinoma of the bones of the skull—none give this diffuse picture.

Clinical History. This is against malignant disease, because the first bone growth was found five years ago. For one year previous to this there had been pain in the teeth. The patient also gives a history of acute polyarthritis twenty-five years ago with recurrent mild attacks since. The second bone enlargement appeared three years after the first. Then nodules appeared rapidly, the last ten days ago. With the appearance of a bone nodule on the skull, there followed quickly over it tenderness and edema. This has been observed by the patient and her physician. The tenderness and edema disappear leaving the irregular thickening on the surface of the skull. The patient thinks some of the bony nodules have disappeared. Dr. Ginsberg has observed them to become smaller, but never to disappear. With the appearance of the tenderness and edema there is sometimes fever and a leukocytosis of 15,000 and a polymorphous leukocytosis of eighty-two per cent. There



Figure XVII.—Case VIII.—Pathol. No. 29831. Infectious ossifying periostitis of bones of the skull. Focus of infection root abscesses of teeth.



Figure XVIII.—Case VIII.—Pathol. No. 29831. Infectious ossifying periostitis of bones of the skull. Focus of infection root abscesses of the teeth.

have also been intermittent attacks of edema of the eyelid, the first two years ago, the last two weeks ago; headaches have been a prominent feature for two years without nausea or vomiting. Eight months ago there was blurring of vision with choke disk which gradually disappeared. A recent complete neurological examination is negative. A nodule appeared some months ago on the rib and disappeared.

In spite of a negative Wassermann one year ago, antiluetic treatment was pushed to the limit without help.

Every possible examination has been made, thoroughly and repeatedly. The positive findings are the changes in the skull and the abscesses of the teeth which have now been extracted.

I advised Dr. Ginsberg to have all the remaining teeth extracted, and then to consider the question of removal of both tonsils, which are buried and suggest slight infection, although there is no history of tonsillitis.

CONCLUSIONS

I am now restudying all of my old and recent observations of osteomyelitis of all types and of ossifying periostitis.

This is but a preliminary report with the hope that it will stimulate a search for bone lesions of this type. For the present no conclusions should be made.

Apparently there is a definite type of non-suppurating ossifying periostitis or sclerosing osteomyelitis. I have sufficient cases to demonstrate that trauma

and syphilis may produce it. It is observed as a post-typhoid and post-influenza lesion, and apparently it may be secondary to any type of infection.

As a single lesion in the early stage it will present difficulties in differentiating it from periosteal sarcoma. When it is multiple, sarcoma can be excluded. The x-ray picture, as far as my experience goes differentiates it from multiple osteitis fibrosa and metastatic carcinoma.

The most important points in treatment are the administration of salvarsan intravenously and a search for the focus of infection, which, when found should be removed. I have no evidence as yet that incision with removal of the new bone formation is helpful.

The Value of Imbedding Radium in the Treatment of Carcinoma of the Breast*

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TREATING carcinoma of the breast by imbedding radium throughout the gland and adjacent glandular tissue, supplemented by surface applications of radium and heavy filtered x-ray, makes radiation as thorough as amputation in both early and late cases. After such radiation, removal of the fibrous portion of the breast may be indicated, but a radical operation is seldom ever necessary.

The reason for advocating radium by the method described is that early

cases can be clinically cured without opening the lymphatic channels and if operation is indicated later, it is performed when the cancer cells are nearly all destroyed, that is when cell proliferation is checked and only latent cancer cells are removed. In many cases at least imbedding radium takes the place of operation, but until we have more data, it may be advisable to operate between four and six weeks after primary radiation, when cancer cells are sickened, as William J. Mayo expresses it. In late cases radiation as

just described is superior to any form of an operation primarily, and in these cases if the breast is removed, at least the axilla should scarcely, if ever, be opened following radiation. At present probably the safest method to follow is to give sufficient surface treatment of radium or x-ray and then two or three weeks later to imbed radium throughout the breast, into the glands of the axilla and into the glands leading from the axilla to the breast, and then four weeks later to remove the breast and as much of the adjacent

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.



Figure I.—Inoperable carcinoma of the breast, thirty-seven needles inserted into the breast and adjacent tissues for five hours, two months after surface application of x-ray and radium had been given.

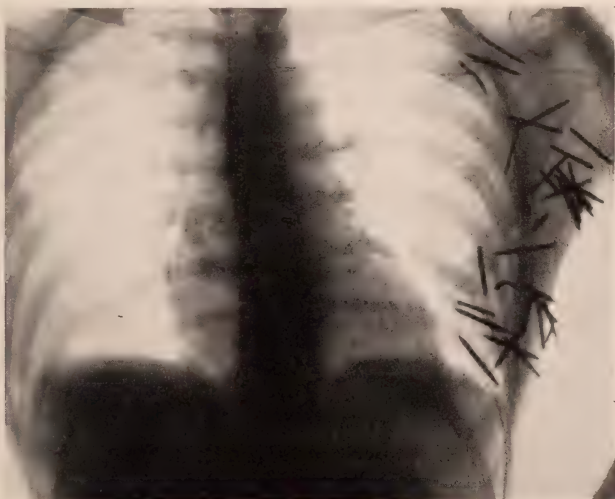


Figure II.—Roentgenogram of the same case, showing the needles imbedded in the tissues.

tissue as is deemed necessary. If the removal is done at this time, it will be done before much fibrous tissue has formed.

In all the progress made in recent years in radiotherapy, nothing has been evolved of such significant import in the treatment of carcinoma of the breast, as the advanced method of imbedding radium, with its manifold and varied advantages and possibilities in deep therapy. By imbedding radium throughout the entire breast, in the axilla, into the glands leading from the breast to the axilla and into the glands below the clavicle, this supplemented by deep x-ray therapy, radiation is made as thorough as a radical dissection without opening the lymph channels.

In the early days of radiotherapy a deep lethal dose could not be given without producing superficial ulceration or necrosis. By imbedding radium a lethal dose can be given without any effect on the skin. Besides the subcutaneous tissue will tolerate from three to five times as much radiation as the skin. The result of radium in malignancy depends upon whether a lethal dose is given. Formerly it was concluded, because our best radiograms were taken with comparatively low tubes, that this form of radiant energy was the most suitable for deep therapy. Almost every one overlooked the loss of energy by absorption in the tissues and by divergence of the rays, and practically nothing was known about the lethal dose of different types of malignant cells. Most radiologists compared everything with the amount

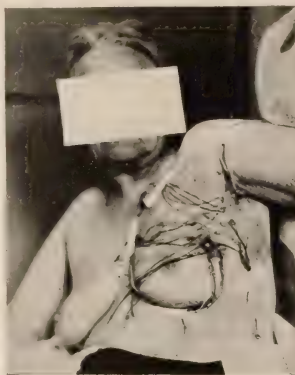


Figure III.—Advanced carcinoma of the breast with marked axillary involvement. Thirty-six radium needles inserted for six hours. Disease in the glands and the breast has entirely retrogressed and the patient is clinically cured.

of radiant energy necessary to destroy rodent ulcer; and when the squamous cell epithelioma, axillary nodes and a cancerous mass in the breast did not disappear under x-ray, the radiation was considered useless. The real fact was that a lethal dose had not been given.

Radiation for the treatment of carcinoma of the breast has been so changed by imbedding radium that where only superficial skin effects were formerly produced, now cancerous tissue deeper than that which can be removed by the knife can be destroyed without opening the lymphatic chains.

Before imbedding radium I always give surface applications in the axilla and over the glands below the clavicle, and I give a complete course of heavy filtered x-ray treatment to the breast and all the glands draining it. This checks cell proliferation and lessens the danger of metastases when the breast and adjacent lymphatics are spared and radium inserted. It is generally agreed that it requires from two to four weeks to check cell proliferation. It has been shown that the lymphatics begin to undergo a fibrosis at the end of the fourth week and that the caliber of the lymphatic vessels is smaller than before treatment was given. It seems just as advisable to give surface treatment before imbedding radium as before operation. Some few surgeons are now advising ante-operative treatment, and if they would include imbedding radium and remove less tissue, thereby leaving the sclerosed lymphatic tissue as a barrier against cancer cells I feel sure that the end results would be better, at least in borderline cases; that is, there would be fewer recurrences, and if a recurrence did take place it would be considerably later than when the operation precedes radiation.

Imbedding radium in the treatment of carcinoma of the breast is a step in advance, but the number of cases treated by this method are not sufficient and its use is of too short duration to speak about anything but temporary results. Even in some of the advanced cases the disease in the breast and the glands appears to have retrogressed, clinically. Not enough cases have been operated upon to give definite histological changes.

A study of the lymphatic and bone metastases will show that although the case is operated upon early, raying as usually given in the past, that is, raying the line of incision, axilla and supraclavicular region, is very incomplete because there are twenty or more chains which drain the breast. The most important of these which metastasize beside the axillary and supraclavicular are the suprascapular, anterior pectoral, internal mammary, subscapular, paravertebral, xiphoid, and inguinal groups.

According to Handley, the frequent involvement of the liver is attributed to the cancerous dissemination along the deep lymphatics of the fascia of the thoracic wall to the epigastrium and to the umbilicus, whence these cells follow the subserous lymphatics to become deposited either on the surface of the liver or are conveyed along the lymphatics of the falciform ligament to the portal glands. If Handley's deductions are correct, we should never omit heavy treatment over the epigastric region. Next in frequency are the lungs and

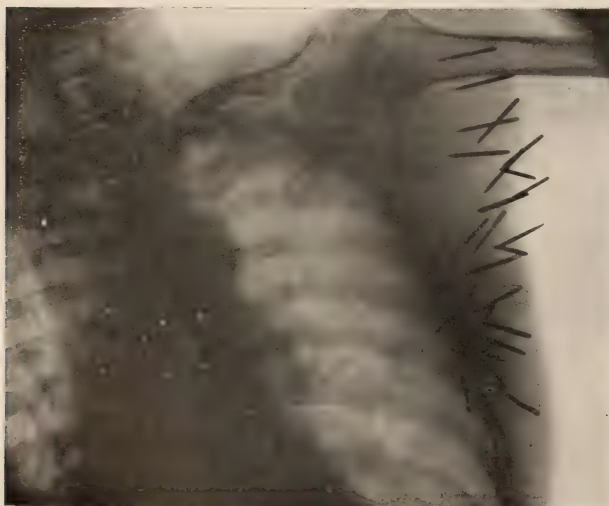


Figure IV.—Boentgenogram of Figure III, showing the needles in position.

pleurae, which are supposed to become involved through the intercostal or supraclavicular lymphatics.

Many consider a three year limit as a cure of cancer of the breast, but we cannot be sure that recurrences will not take place later. Barker has stated that thirty per cent of the cases that are clinically cured at the end of three years, later die of cancer of the breast. Since operation has about reached its limits and since ultra-radical operations are not practical until some better form of treatment is discovered, the splendid results achieved from radiation furnish more than sufficient reasons for giving every case of carcinoma of the breast efficient radiation. This should be done even if the tumor is small, because even in such cases there may be early and fatal metastases. Handley says that the pelvic viscera are involved in 8.6 per cent of early cases in young patients and in 4.8 per cent of the older patients.

It has been proved that four out of five patients in whom carcinoma is confined to the breast, as proved by microscopic examination of the tissues adjacent to this organ, are cured by radical operation. When axillary lymph nodes are found to contain cancer microscopically, the patient has only one chance out of five of being cured by operation. This deduction is practically the same as that of Halstead, who says that notwithstanding the present day extensive operation, death from metastases occurred in 23.4 per cent, even in cases with a microscopic negative axilla. It is being generally conceded by the surgeons that there is more palliation received from radiation in inoperable cases than that which is accomplished by any other method. At present there is a growing general dissatisfaction with operation of a palliative nature in the treatment of carcinoma of the breast. An incomplete operation never checks the progress of carcinoma, but on the other hand usually hastens death both in the early and late cases.

The prognosis and treatment of mammary carcinoma can be estimated only after careful consideration of many factors. Nearly all surgeons consider operation contra-indicated when there is extensive ulceration, when the tumor is adherent to the chest wall; when the axillary nodes are fixed; when there is supraclavicular involvement; and when there is indication of distant metastases. When the axillary glands are palpable there are very few cures from surgery alone without radiation, even when the axillary nodes are not palpable, and when the glands are found to contain cancer cells microscopically only about twenty per

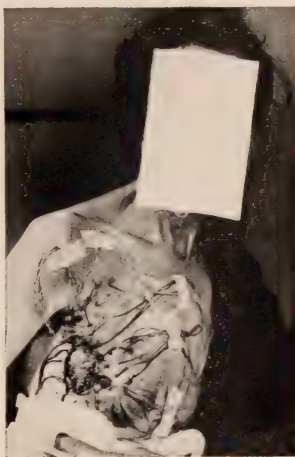


Figure V.—Inoperable carcinoma of the right breast. Thirty-two radium needles inserted into the breast and adjacent tissue for six hours. Surface application of radium and the x-ray, which preceded imbedding the radium, greatly reduced the mass in the breast.

cent of the cases are cured at the end of five years.

Greenough claims that when the axillary nodes are palpable, 12 per cent were cured by operation, and Finsterer stated 4.3 per cent. The latter represents the average success of surgery, which means that a woman who has a well established cancer of the breast, with palpable axillary nodes, has one chance in twenty-five of being cured by operation. Therefore, in cases of this

class it is not too much to advise imbedding radium and giving a thorough course of radiation before the removal of the breast.

In conclusion, even in some of the advanced cases the disease in the breast and in the glands has clinically retrogressed by imbedding radium. Of course in some cases there is still thickening due to the fibrosis from the radiation. In the inoperable cases usually we were inclined to leave well enough alone, and in the early cases each one has refused operation. My advice has been, even in the advanced cases where the disease has clinically receded, to have the breast removed after extensive radiation without opening the axilla, but to my extreme disappointment, in almost every case that I have turned over to the surgeon, the axilla was opened and when the patient returned, in nearly every instance she would have a swollen arm and was in much worse condition than before operation. I feel sure, however, that if we could have the surgeon remove only the breast, thereby taking away the unhealthy mammary gland, the patient would be greatly benefited. I am speaking of the advanced or inoperable cases which have had thorough radiation, and not the early cases which we are advising to have ante-operative radiation.

Successful treatment in carcinoma of the breast can be attained only by the total eradication or degeneration of all cancer cells present throughout the body, whether the method selected is surgical or radiological.



Figure VI.—Roentgenogram of Figure V., showing the needles imbedded throughout the breast and surrounding tissues.

An Effect of X-Ray on the Germ Cells*

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THE experimental work here to be described was undertaken at the suggestion of and with the assistance of the Research Laboratory of the General Electric Company. The experiments have been carried out at the Biological Laboratory of Union College. The first object has been to search for a specific effect of x-rays on the dividing cell. A second problem which has grown out of the first has been the modification of the germ cells by external means.

The egg cells are actively growing cells which continue their growth in the ovary of the adult. Since we know in great detail the method of division and the different phases through which primitive egg cells pass as they become mature eggs, these provide a ready and convenient means of testing the effect of x-rays on dividing cells. Further, since these cells after fertilization give rise to new individuals, we have a means of testing for slight effects which might not otherwise be noticed. In our experiments we have investigated the effect of x-rays on the egg cells of a small fruit fly and compared them with their effect on the adult tissue.

The understanding of these experiments demands a certain knowledge of the life cycle of the fruit fly and of Mendelian inheritance. Like all other flies, the fruit fly hatches from a small egg as a larva or grub. This larva feeds on the yeast which grows on fermenting bananas. After feeding for four or five days the larva crawls out of the banana and forms a pupa. In this pupa the larva metamorphoses into an adult fly which emerges about four days after the pupa is formed. This fly is soon able to lay eggs. So that the complete cycle takes from nine to ten days. The flies are easily reared in bottles, and a single pair placed in a bottle containing a ripe banana will give from two to three or more hundred offspring in the first generation.

By a mutation is understood a character which appeared suddenly and is inherited. Practically all mutations are inherited, according to Mendel's law. As an example of this law may be taken the inheritance of any of the two hundred or more mutations which have been found in the fruit fly. If a fly with vestigial wings is crossed with one with normal wings the offspring

in the first generation will all, without exception, possess normal wings, but if these flies be crossed *inter se* a part of the offspring will be normal winged and a part will be vestigial winged in the proportion three to one, and there will be no intermediates. Normal wing is said to be dominant to vestigial wing. This law has been tested for some characters with very large numbers so that it is known with a precision comparable to any physical or chemical law.

An explanation of this peculiar ratio may be found in a study of the process of maturation and fertilization of the germ cells. When the nucleus of any cell divides there appear certain bodies called chromosomes. The number of these chromosomes is always constant for a given species and when the nucleus divides each chromosome divides. During the maturation of the egg at one stage a reduction division occurs during which the nucleus divides without the chromosomes dividing, so that the mature egg contains only half the normal number of chromosomes. Similarly when the sperm is formed there is a reduction division so that it also contains only half the normal number of chromosomes. When fertilization occurs and the sperm and egg combine the normal number of chromosomes is restored. Further, a more careful study of chromosomes has shown that those in a single cell are not all alike, but can be arranged in pairs and from the phenomena of fertilization it is clear that one chromosome of each pair was in the sperm and came from the father and one chromosome of each pair was in the egg and came from the mother.

Let us now see if the behavior of the character vestigial wing in inheritance can be interpreted in terms of the chromosomes. Whatever it may be which determines that the resulting fly shall have normal wings let us suppose it to exist in the members of a pair of chromosomes, and let us suppose that a race of normal winged flies which breeds true this "determiner" exists in both the chromosomes of the pair. Similarly, suppose that a race of flies with vestigial wings which breed true the "determiner" for vestigial is in both the chromosomes of a pair. When two of these flies are crossed the fertilized egg will have in the case of one pair of chromosomes one chromosome from the normal winged parent and one chromosome from the vestigial winged

parent. We know that the offspring are all normal winged. Let us then suppose that the normal-wing determiner overpowers the vestigial wing determiner when both are together. What will happen if these offspring are bred *inter se*? Both the sperm and the eggs will be of two kinds, one with a chromosome carrying the determiner for normal-wing, the other carrying the determiner for vestigial-wing. Either of the kinds of sperm has an equal chance of uniting with either of the kinds of eggs. For every four eggs which are fertilized we get one in which the determiner for normal-wing is in both chromosomes, one in which the determiner for vestigial-wing is in both chromosomes and two in which one of the pair of chromosomes carries the determiner for normal-wing and one the determiner for vestigial-wing. Since the presence of the determiner for normal-wing in even one of the chromosomes makes the offspring have normal wings we have for every four offspring three normal winged and one vestigial winged. But these three normal winged flies are not all alike, one of them will be expected to breed true and two of them will behave as their parent, that is, will give normal winged and vestigial winged flies in a three to one ratio. When they are bred this is found to be the case.

There is a certain class of mutations which behave rather differently in inheritance from the example I have chosen. They are called sex-linked. They are not, however, to be confused with secondary sexual characters with which they appear to have nothing in common.

If a red-eyed female is crossed with a normal white-eyed male the sons and daughters are all red-eyed. If, on the other hand, a white-eyed female be crossed with a red-eyed male the female offspring are all red-eyed and the male offspring white-eyed. How can this be explained on the basis of determiners in the chromosomes? There is one pair of chromosomes which differ from the others. Those are called the sex chromosomes. They form in the female a perfect pair, but in the male one is of the type in the female pair (X) and the other has a hook (Y). It is easy to see that the sex of the fly depends on the number of X-chromosomes in its cells, a cell with two X's being female and the one with one X a male. When the female forms eggs they are all of one kind and each has an

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 8, 1921.

X-chromosome. When the male forms sperm they are of two kinds, one with an X and one with a Y-chromosome. When an egg is fertilized by an X bearing sperm it becomes a female and when it is fertilized by a Y bearing sperm it becomes a male.

Let us suppose that the determiner for red eye is in the X-chromosome. A red-eyed male will have this determiner in one chromosome. A white-eyed female will have the determiner for white eye in both its X-chromosomes. If they are crossed we would get the result shown in the diagram. The mature eggs have one chromosome bearing the white-eye determiner and when one is fertilized by a sperm bearing an X it will receive a chromosome bearing the red-eye determiner. If red eye is dominant it will be red-eyed, and because it has two X-chromosomes it will be a female. When, on the other hand, an egg is fertilized by a sperm bearing a Y-chromosome it will be white-eyed, because of the white-eye determiner received from its mother and the absence of any red-eye determiner received from its father, and it will be a male because it has only one X-chromosome.

This, then, briefly is the mechanism of Mendelian inheritance. It is upon this mechanism that I have tested the effect of x-rays.

Preliminary experiments showed that the sterilization dose of x-rays was small compared with the lethal dose for female flies, so that flies could be sterilized without apparently affecting them in any other way.

In all experiments an equal number of control matings were kept under the same conditions as those under which were kept the rayed pairs. In the first experiments virgin red-eyed, wild-type female flies were rayed. These females were obtained virgin by isolating pupae in test tubes. The females were rayed sticking together of two chromosomes

soon after emerging from the pupa cases with a dose just under the sterilization dose and immediately mated in rearing bottles with white-eyed males. The pairs of flies, both the control pairs and the rayed pairs, were then transferred to new rearing bottles every six days. The offspring of the pairs in each bottle were counted every day. It will be remembered that in a regular cross the offspring of a red-eyed female by a white eyed male are all red-eyed.

A word as to the results obtained in the case of the control and rayed pairs in the first bottles of the first four experiments: In this experiment the seven control pairs produced in the first bottles 545 red-eyed males and 501 red-eyed females and no white-eyed flies. The six pairs in which the females were rayed produced 81 males and 77 females; of the 81 males 10 or 12.3% were white-eyed and five out of the six pairs produced one or more white-eyed males. Further, it was noticed that the white-eyed flies are among those emerging on either the third or the eighth day. This probably means that they came from eggs which were in one of two stages of the maturation process when their female parents were rayed.

The results of the first four experiments were then combined so as to include only the offspring obtained during the first six days, the period during which white-eyed flies were obtained.

The production of these white-eyed males by x-rays may be accounted for by assuming that the X-chromosome was destroyed or otherwise eliminated by the rays.

In one experiment a white-eyed male occurred in the control. This was probably due to non-disjunction, that is, to the failure of the two chromosomes to separate in maturation and suggests that the effect of the x-rays may be to cause non-disjunction or a

rather than the elimination of one. The next series of experiments were carried out to test this.

Virgin white-eyed females were rayed and mated to eosin-eyed, miniature winged (both sex-linked recessive characters, eosin-eye being, however, dominant to white-eye). It will be remembered that the regular offspring of such a cross are eosin-eyed females and white-eyed males. The seventeen control females produced 1,726 regular males (white-eyed) and 1,743 regular females (eosin-eyed) and one eosin-eyed miniature-winged male. This latter was an exception due to non-disjunction occurring naturally. The 13 rayed females produced 467 regular males (white-eyed) and 512 regular females (eosin-eyed) and in addition 12 exceptional males (eosin-eyed, miniature-winged) and 2 exceptional females (white-eyed). Further, of these 13 rayed females 4 produced less than 10 offspring, and the 9 remaining rayed females, which produced more than 10 offspring, each produced either exceptional males or females. The two females were produced by different females.

It seems clear from the second series of experiments that an effect of x-rays is to produce non-disjunction or a failure of the X-chromosomes to separate in the female during maturation.

To sum up, a specific effect of x-rays has been shown in the dividing germ cell which leads to a specific modification in the inheritance of the offspring.

EDITOR'S NOTE—*This thesis was greatly amplified by a number of stereopticon slides showing the tabulated results of the various experiments conducted by Dr. Mavor, and it is matter for regret it has not been possible to reproduce them here.*



A System of Roentgen Ray Anthropometry (The Skull)

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PART II—SECTION A—DESCRIPTIVE

GENERAL CONSIDERATIONS

JUST as the measuring of the skeletal parts differs in many respects from that of measuring the living, so does the measuring of the skeletal and fleshy silhouettes of the roentgenogram of the head differ from either craniometry or cephalometry. Moreover, roentgen ray anthropometry is especially attractive by reason of the cleanliness of the investigation and because, unlike any other branch of anthropologic enquiry, roentgen ray anthropometry offers a field of study heretofore impossible; that of investigating the ectocranium, the endocranium and in great measure the soft coverings of the head; and all these in the living.

In this country the study of physical anthropology may be said to have begun with the researches of the immortal Samuel G. Morton in Philadelphia, in 1830. The historical development of this incident is interesting, and according to Morton himself, the beginning of his actual work in anthropology is related to have occurred as follows:

"Having had occasion, in the summer of 1830, to deliver an introductory lecture to a course in anatomy, I chose for my subject, 'The Different Forms of the Skull as Exhibited in the Five Races of Men.' Strange to say, I could neither buy nor borrow a cranium of each of these races; and I finished my discourse without showing either the Mongolian or the Malay. Forcibly impressed with this great deficiency in a most important branch of science, I at once resolved to make a collection for myself."

With the beginning of anthropological studies in America, as initiated by Morton, it will be observed that attention is directed first to craniology. The cranium is naturally the most interesting and the most important part of the skeleton; and it is no wonder that the preoccupation of anthropology with the skull has been such as to overshadow the study of the rest of the skeleton. Craniometrical methods and instruments have multiplied perhaps a little beyond the actual need. The first earliest summary of this mass of research was made by Broca, Vogt and Topinard, and more recently has been condensed and selected so as to conform with the admitted efforts toward standardization by the Monaco and

Geneva Conventions and presented in the two most valuable current contributions to anthropology entitled, respectively, (1) "Anthropometry" and (2) "Physical Anthropology," both under the authorship of Dr. Ales Hrdlicka.

Hrdlicka's Anthropometry is the model after which roentgen ray anthropometry is patterned. It will be the aim to parallel such measures and observations enumerated in Hrdlicka's "Anthropometry" as may be obtained from the study of the roentgenogram; to supply, for the same subject, such cephalometric measures and observations as the roentgenogram may provide in accordance with Hrdlicka's standards; and in addition, as nearly as possible to approximate such other useful anthropologic characteristics as may prove of value in the immediate application of roentgen ray anthropometry to clinical studies.

Certain preliminary procedures are considerably important and must necessarily be observed before beginning either a description or measure of the skull. These are included under three general heads, namely, (1) sexing; (2) estimation of the age, and (3) determination of normality.

SEXING

Female crania differ from the male by the same characters which tend to distinguish the female skeleton from the male skeleton. Ecker early remarked on the lesser development of the processes serving for the attachment of the muscles in the skeleton of the female, a process especially perceptible in the mastoid prominence, the temporal and cervical lines, and the ridges on the lower jaw. In the male skull the protuberances of the osseous cavities are more developed, as is seen in the superciliary ridge produced by the bulging of the frontal sinuses. In regard to the size it has always been accepted that the female skull is absolutely smaller than the male skull; Welcker furnished accurate information on this topic in 1862 for the first time. Ecker in 1866 studied the proportion of the cranium to the face as a whole, and that of the separate parts, and concluded that the female cranium presented certain cranio-facial relations that distinguished it from the male cranium. This subject has more recently been revived under the topic of cranio-facial index mentioned by Bean, and will be referred to again later in this thesis.

Topinard remarks that sex can not be recognized with infallible precision from any one character, but is inferred from the study of a group of characters, among which he names the shape of the feminine head, intermediate between that of the infant and adult man; the general gracefulness and fineness; the lesser prominence of the muscular insertions and the bony processes. The following points, says Topinard, should receive preferential attention; the forehead which is, all other things equal, straighter in the female than in the male skull; the superciliary ridges and the glabella, infinitely less developed in the female; the high and horizontal vault of the feminine cranium; the relatively less capacity and weight of the skull; the mastoid and the styloid processes, both of conspicuously less development in the feminine as compared to the masculine skull; and the massiveness of the zygoma and the alveolar processes, less in the female than in the male.

As Hrdlicka remarks, there are male skulls which in some or all of their features are less masculine than the average; and similarly, there are female skulls that in some or all of their parts resemble the masculine. There is no sharp dividing line, but rather an interdigitation and continuity, as a result of which, in certain cases, the sexual identification of a specimen remains uncertain despite all the efforts of the anthropologist.

Roentgen ray anthropometry introduces the concept of the "summation of sex characters." In roentgen ray anthropometry, as conducted on the living, the sex is definitely known; and it might appear at first consideration, superfluous, to conduct any observations bearing upon sexual identification. It was observed, however, that in certain types of mental deficient showing strongly developed homosexual traits, that the summation of sexual characters as obtained from a study of the cranial roentgenogram often leads to inferences that were at variance with the true anatomical sex of the individual. It is felt that this observation is fraught with intrinsic potential value in the study of mental deficient from the viewpoint of anthropology; and also that it may lessen the percentage of inferences in the identification of the sex of crania as practiced by the anthropologist who has no way or means for checking the accuracy of his observations.

The instructions given by Hrdlicka for establishing the sexual identification of a cranium are, in summary, as follows: The observer notes first the size of the vault as well as that of the face; a large size speaks normally for a male and the small size for a female. The features observed next and in the order named, are the supraorbital ridges, the mastoids, the zygomata, the occipital crests, the lower jaw, the palate and the teeth, the facial "physiognomy" and the base of the skull.

SIZE

The roentgenogram lends itself to the study of many of these characters, such as the size, the smoothness, the supraorbital ridges, the mastoid process, the zygomata, the angle and the strength or massiveness of the lower jaw. As mentioned previously, Welcker established what had always been accepted, that the female skull is absolutely smaller than the male skull. It is sufficient to record the size of the cranium as revealed upon the roentgenogram according to the following nomenclature:

Size	
Female	1 very small
	2 small
	3 intermediate
	4 large
	5 very large
Male	

These terms are purely qualitative and would vary for studies applied to different races; but in a series limited to one race they acquire a more nearly quantitative value. Arbitrary values have been assigned according to the descriptive terminology; so that a very small head of any series could be arbitrarily valued as one, and a very large head in that same series would receive a value of five.

SMOOTHNESS

Having observed the size of the head and recorded its arbitrary value, the investigator next examines the smoothness. The smoothness is manifested by the gracefulness of the cranial curves, by the absence of step-like depressions or elevations along the median sagittal suture, but more especially at the bregma, lambda and the occipital crests. It may be recorded, pursuant to the general method of roentgen ray anthropometry, according to the following nomenclature:

Smoothness	
Female	1 very smooth
	2 smooth
	3 intermediate
	4 rough
	5 very rough
Male	

SUPRAORBITAL RIDGES

Next in order the supraorbital ridges are studied. On the average these are

decidedly more developed in the male than in the female. According to Bianchi, in human crania the spongy tissue of the frontal bone above the nasion becomes absorbed between the sixth and eighth years of age and thus initiates the formation of the frontal sinuses. This is furthered by the evagination into this spongy tissue of the mucous membrane lining the nasal cavity, and by the exertion of this membrane of its osteolytic capacity (McMurrich). According to Sappey, at puberty and after, the sinuses dilate, thus accentuating the glabella and making prominent the superciliary ridges. Mantegazza believes that the sinuses continue to increase in adults and even in the aged. Bianchi established the independent development of the superciliary ridges apart from the simultaneous development of the frontal sinuses; and it is common experience to note that the congenital absence of frontal sinuses is not necessarily accompanied by absence of the superciliary ridges. The degree of development of the

superciliary ridges or supraorbital ridges may be characterized as follows:

Supraorbital Ridges	
Female	1 trace
	2 slight
	3 moderate
	4 medium
	5 pronounced
Male	
	6 excessive

It is the rule that pronouncedly or excessively developed supraorbital ridges are never observed in the female; neither are ridges that might be classed as "traces" found in adult males. Schaaflhausen attributes the more marked superciliary ridges in man than in woman to the relation which exists between muscular development and the projection of the brows.

Broca traced the superciliary ridges and provided a scale from zero to four, which is here reproduced. It is not necessary that this scale should be rigorously applied. The terms above employed are adequately descriptive. A supraorbital ridge somewhere between number zero and number one of

FROM BROCA'S "INSTRUCTIONS CRANIOLOGIQUES ET CRANIOMETRIQUES", PARIS, 1875, (PLANCHE VI) AND RIBBE, THESE 97, PARIS, 1885.

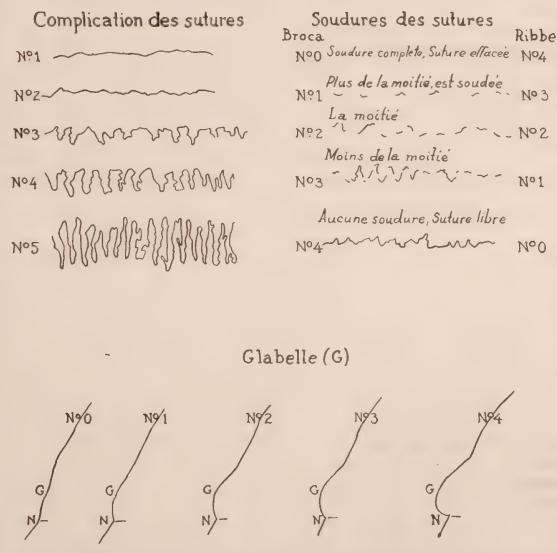


Figure IV.—From Broca's "Instructions Craniologiques et Craniométriques" Paris, 1875, (Planche VI.) and Ribbe, These 97, Paris, 1885, showing a scale for interpreting suture serration; a scale for quantitatively recording suture occlusion; and the degree of protuberance of the superciliary ridge or glabella.

Broca's four would be called excessive, and a protuberance more marked than Broca's four would be called excessive. Qualitative degrees between these two would be slight, moderate, medium and pronounced (see Fig. 4).

MASTOID PROCESS

Next in order the study of the development of the mastoid process is important. This process is formed by the posterior extremity of the petrous bone and is relatively small at birth, when it contains no air cells excepting in the antrum. It develops and becomes permeated with cells as age increases. Its development is largely determined by the sternocleidomastoid muscle which inserts into the mastoid process of the temporal bone. Male mastoids are larger than female processes; so that small mastoids do not occur in males, neither do large or excessive mastoids occur in females. In the median sagittal projection of the skull, on the roentgenogram, the mastoid process must be sought with great care, as in this exposure its silhouette is superimposed over the shadow of the bodies of the atlas and axis.

An estimate of the degree of its development is best gained by visually completing the basi-occipital rotundity and noting the size of the triangular silhouette projected by the mastoid process as it extends from this rotundity with its base attached to the occiput and its apex pointing downward and forward. From the length of the basilar attachment to the occiput, and the height of the triangular apex, the size of the mastoid process is accurately judged. The values for the mastoid process are:

Mastoid Process	
Female	1 small
	2 moderate
	3 medium
	4 large
	5 excessive
	Male

ZYGOMATA

Panichi was early impressed by the protuberance of the zygoma, an anatomic entity that had previously attracted the attention of Luschka and one of his disciples, Werfer. Panichi was interested more especially in the study of the zygomatic spines which he described under eight types; and for which he developed an index based on the relation that exists between the height of the pyramidal protuberance and the height of the spine referred to the standard of 100 (height of the pyramidal protuberance : the height of the spine : 100 : x). Hrdlicka mentions the massiveness of the entire zygoma as a criterion useful in the distinction of the sex. Zygomata are recorded as:

Zygomata	
Female	1 small
	2 moderate
	3 medium
	4 large
	5 excessive
	Male

Unless care is exercised in producing the cranial roentgenogram the zygoma (sinistral) is not clearly outlined. The massiveness of the zygomata may be in part inferred from the size of the antrum of Highmore as well as from the distinctness of the outline of the zygomatic arch as it courses backward to the glenoid fossa. Only the most slender zygomata escape definite visualization.

MANDIBLE

Morselli in 1875 presented a study on the relation that existed between the weight of the skull and the mandible; and arrived at the conclusion that the inferior mandible of the male is heavier than that of the female; and that the sexual character of the weight of the mandible is an important craniometric criterion for distinguishing between sexes. Mingazzini, elaborating on the previous work of Sandifort and Meckel, communicated his study on the morphologic significance of the angle of the mandible. When the roentgen ray exposure is made according to the formula outlined in Part I, the projection of the sinistral half of the inferior mandible is moderately distorted owing to ray divergence. Any measures that are to be made may be corrected through the method before prescribed; but these corrections need not be applied if it is desired only to gather a qualitative inference of the degree of angularity or a lack of angularity observed in the mandible. The angularity of the lower jaw, as revealed by the prescribed technique on the roentgenogram, may be recorded as:

LOWER JAW	
Female	1 very obtuse
	2 obtuse
	3 intermediate
	4 acute
	5 very acute
	Male

In addition to the angularity the massiveness of the jaw is an important criterion. This may be gauged somewhat from the height of the symphysis; but in judging the height, the size and strength of the mandible should at the same time be observed and their value included in the estimate of that for the height, as follows:

Lower Jaw	
Female	1 very low
	2 low
	3 intermediate
	4 high
	5 very high
	Male

For convenience in recording the sex characters of the cranium a roentgen ray anthropologic chart may be prepared according to the copy presented. The chart is devised so as to record the observation on five crania. The characteristics are observed in the proper order, as indicated on the chart, and the value checked opposite the figure in the column for the skull under study. Following the last evaluation, which is that for the height and massiveness of the lower jaw there is a space for recording the total sum of character value; and underneath this the name, age, sex, height, weight, physical condition and clinical diagnosis of the patient are included. (See mimeographed form, page 326).

SEX VALUE

Obviously the most typically feminine skull in a series would present a summation of the lowest value for each characteristic, which is, according to the scale devised, 7; and similarly the most typical male skull in that same series would be represented by the sum of the maximum characteristics, which is 36. These extreme values are seldom observed. The average between the minimum female characteristics, 7, and the maximum male characteristics, 36, affords a mean of 21.5. The figure 21 may be used to represent the critical sex value. Figures above 21 represent dominantly male individuals, and figures below 21, dominantly female.

The application of this study to the roentgenograms of crania of homosexuals has in certain series presented the peculiar finding that the summation of sex character values in some males was found lower, and in some females higher than 21. This is not only of anthropologic interest, but is also clinically significant to the psychiatrist in pointing to the possibility of viewing

the homosexual as a phylogenetic entity of ontogenetic misfitting; or to use the words of a leader in psychiatry to whom these observation were presented "roentgen ray anthropometry for the first time affords an accurate means for observing the biologic male in the anatomic dress of the female."

SKULL THICKNESS

On the thickness of the vault much has been written; and it was thought by some, as for instance Schaffhausen, that most of the skulls of the highest antiquity are distinguished by the thickness of the cranial bone; but this

may partly be due to great muscular action, and partly to mode of life, which furnished in some cases an excess of calcium phosphate for the nourishment of the bone. So that thickness of the vault, alone, is of no decisive value in sexual identification.

ESTIMATION OF AGE

A correct estimate of the age from the skeleton is not of extreme anthropologic necessity. Generally it suffices to determine whether the skull is sub-adult, adult or senile. For these determinations the anthropologist studies the state of fusion of the basilar suture, that of the epiphyses of the long bone, the stage of dentition, the condition of the teeth and alveolar processes, and the state of the sutures of the vault of the skull (Hrdlicka).

In sagittal view, the basi-sphenoidal suture is not roentgenographically visible; so that its occlusion, a sign valuable to the anthropologist, can not be utilized by the roentgenologist. A study of the epiphyses of the long and other bones is possible, though it necessitates additional roentgen ray exposure. Hrdlicka offers the following table, based upon modern anatomical writings, for the ossification of the various epiphyses:

OSSIFICATION (COMPLETED)

	Year		Age of Fusion (Rotch & Morris)	Age of Fusion (Pacini)	No. of Cases in Average
Basilar suture	20-25	Metacarpals: Epiphyses	20	20	11680
Humerus: upper	20-25	Phalanges: Epiphyses	18	20	11720
lower	18-19	Pelvis: (Pubis and ischium unite at eight years; the acetabulum closes at sixteen years).			
Femur: upper	18-20	Epiphyses for—			
lower	20-22	Crest of ilium		25	630
Tibia: upper	20-24	Ischial tuberosity		13	28
lower	18	Anterior inferior iliac spine	20		
Ulna: upper	16	Tubercle of pubes			
lower	20-23	Femur	19	18	2593
Radius: upper	17-20	Greater trochanter	18	18	2600
lower	20-25	Lesser trochanter	17	18	2430
Fibula: upper	22-25	Lower epiphysis	20		
lower	19-20	Patella:	24		
		Fibula: Upper epiphysis	24	20	983
		Lower epiphysis	20	18	992
		Tibia: Upper epiphysis	22		
		Lower epiphysis	18		
		Tarsus: (In order of appearance).			
		Calcis			
		Epiphysis of calcis			
		Astragalus			
		Cuboid			
		External cuneiform			
		Internal cuneiform			
		Middle cuneiform			
		Scaphoid			
		Epiphyses	20		
		Metatarsals: Epiphyses	18	20	10065
		Phalanges: Epiphyses			
		Sesamoids: of flexor hallucis brevis			
		Vertebrae: Ossification is from three primary centers, one for the body and one for each lateral mass. The nucleus for the body is often bilobed, with a partial plane of cleavage in the vertical or horizontal diameter. The laminae unite during the first year. Five secondary centers described in the anatomies—namely,			

Based on the roentgenographic study of 30,000 cases, given by Pacini, the age of fusion of various epiphyses coincides very closely with the age of those offered by Rotch and Morris. The comparative tables are appended. (Tables of Rotch and Morris modified and copied from Holmes and Ruggles, "Roentgen Interpretation.")

thin plates on the upper and lower surfaces of the body and the tips of the mammillary tubercle, transverse and spinous processes—appear at the age of fifteen to twenty years and unite at twenty-five. The fifth lumbar vertebra is an exception in that it ossifies from five centers, one for the body, one on each side from which is developed the superior articular process, pedicle and transverse process, and one on each side, which subsequently form the inferior articular process, lamina and spinous process.

If the study is directed with the immediate aim of definitely ascertaining the age of the subject, careful roentgenography of the various bones and their epiphyses should establish the age within one or two years when the individual is under thirty; but it is seldom necessary or desirable to direct an inquiry entirely for the estimation of the exact age.

TEETH

The eruption of the temporary and of the permanent teeth is a useful indication of the age of the subject. Deciduous dentition, among whites, is complete usually before the end of the third, and permanent dentition before the thirtieth year of life. A complete set of teeth in a skull is a valuable index pointing to the fact that adult life has

been attained, or nearly attained. Bean gives the following order for the eruption of the permanent teeth:

1. Lower first molars,
2. Lower median incisors,
3. Upper first molars,
4. Upper median incisors,
5. Lower lateral incisors,
6. Upper lateral incisors,
7. Upper median premolars,
8. Lower canines,
9. Lower median premolars,
10. Upper lateral premolars,
11. Upper canines,
12. Lower lateral premolars,
13. Lower second molars,
14. Upper second molars,
15. Lower third molars,
16. Upper third molars.

From a composite study of Bean, Bednar, Cherot, Gray, Matiegka and others, Hrdlicka furnishes the following data relative to the eruption of temporary and permanent teeth in whites:

ERUPTION OF TEETH IN WHITES

First Dentition

	Months
Median Incisor, lower.....	4-8
Median Incisor, upper.....	8-11
Lateral Incisor, upper.....	8-11
Lateral Incisor, lower.....	12-15
First Molar, upper.....	9-21
First Molar, lower.....	12-21
Canine, upper.....	16-24
Canine, lower.....	16-25
Second Molar, upper.....	20-36
Second Molar, lower.....	20-36

Permanent Dentition

	Years
First Molar, lower.....	4-7
First Molar, upper.....	5-8
Median Incisor, lower.....	5-8
Median Incisor, upper.....	5-8
Lateral Incisor, lower.....	6-10
Lateral Incisor, upper.....	6-10
Anterior Premolar, upper.....	7-14
Canine, lower.....	8-14
Anterior Premolar, lower.....	8-15
Posterior Premolar, upper.....	9-15
Posterior Premolar, lower.....	9-15
Canine, upper.....	9-16
Second Molar, lower.....	10-17
Second Molar, upper.....	10-17
Third Molar, lower.....	15-30
Third Molar, upper.....	17-30

In a skull the wear of the teeth, as Broca taught, gives valuable information indicating advancing age. In the white race there is little wear before the thirty-fifth year of life, nor is it marked before the fiftieth year; and in many subjects the wear may remain slight up to very old age. Bean indicates that the decay of the permanent teeth occurs earlier in types which he calls hyperontomorphs (individuals with long faces, heads and noses, and large occipital circumferences), than in those types called by the same author

ROENTGEN RAY ANTHROPOLOGY
(Sex Character of the Cranium)

No. 1

CHARACTERISTIC	Value				
SIZE:					
very small	1				
small	2				
intermediate	3				
large	4				
very large	5				
SMOOTHNESS:					
very smooth	1				
smooth	2				
intermediate	3				
rough	4				
very rough	5				
SUPRA-ORBITAL RIDGES:					
trace	1				
slight	2				
moderate	3				
medium	4				
pronounced	5				
excessive	6				
MASTOID PROCESS:					
small	1				
moderate	2				
medium	3				
large	4				
excessive	5				
ZYGOMATA:					
slender	1				
moderate	2				
medium	3				
strong	4				
massive	5				
LOWER JAW:					
very obtuse	1				
obtuse	2				
intermediate	3				
acute	4				
very acute	5				
UPPER JAW:					
very low	1				
low	2				
intermediate	3				
high	4				
very high	5				
Total sum of character values					
Name					
Age					
Sex					
Height					
Weight					
Physical condition					
Clinical Diagnosis					

hypo-ontomorphs (individuals with broad heads, faces and noses, and large parietal circumferences of the head).

In addition to serving as a means for estimating the age, the form and state of soundness or decay of the teeth may point to the state of integrity of the endocrine secretory balance. Thus, Barker states that in *status lymphaticus* the two central incisors are abnormally large and the two lateral incisors very small. Delayed dentition may be a sign of pathology, such as rickets, or abnormality of cryptorhetic function (goiter, myxedema). If the first dentition is delayed, the sequence of appearance of the permanent teeth may be disturbed, and they may then be badly developed, misshapen, or eroded. Caries may be accompanied by conditions of myxedema and also dysfunction of the parathyroid glands. The position of the teeth is important, as in acromegalic changes wherein the individual teeth do not appear to change much in size, but the spaces between them become greatly widened ("hag teeth"), owing to the enlargement of the jaw, a valuable and often early sign in this pituitary disorder.

With advancing senility the bones of the skull, as well as those of the rest of the skeleton evidence rarefaction. In the jaw this is accompanied by an extensive loss of teeth and marked absorption of alveolar processes. Edentulous jaws that are greatly thinned and have assumed a pronounced and increasing obliquity are evidences of advanced senility.

CRANIAL SUTURES

The obliteration of the cranial sutures has been used to assist in estimating the age. It is valuable when studied in conjunction with other indications. The study of cranial sutures is interesting and important, not alone from the viewpoint of age estimation, but also from that of pathology, more especially rickets.

On the roentgenogram of the sagittal view of the head, excepting in old age, the lambdoid suture is normally visible, and less frequently the coronal suture. The sagittal suture, because of its lateral projection, can be studied indirectly by noting the contact at important junctions, such as at the bregma and lambda.

As Ribbe pointed out, the sagittal suture consists of four divisions which from front to back are: (1) the bregmatic portion; (2) the vertical portion; (3) the obelion portion; and (4) the paralambdoid portion. At the bregma there may be an elevation or depression where the sagittal meets the coronal suture; and similarly at the lambda there may be most usually a depression as the occipital bone bulges

outward where the sagittal meets the lambdoid suture. Beyond these remarks the study of the state of fusion of the sagittal suture can be inferred only from the general configuration of the head. In scaphocephaly, in which the sagittal suture is fused, lateral expansion of the vault is interfered with so that the head grows lengthwise in the plane of least resistance; and it assumes the "boat-keel" form characteristically observed in the negro, and in white skulls, and others, where the sagittal suture has early fused as the result of pathology.

Each half of the coronal suture presents three distinguishable portions. These are: (1) the bregmatic, (2) the complex, and (3) the occipital. The bregmatic portion is relatively short (Ribbe gives three centimeters as the average length). A great part of the bregmatic portion of the coronal suture is in a more or less horizontal plane and is, therefore, not projected on the roentgenogram of the sagittal view of the head. The complex portion is so named because of the intricacy and length of the tortuous dendrites that compose it. This portion of the coronal suture is more nearly vertical in its position on the cranium and when patulous it is projected onto the roentgenogram. It is practically the only portion of the coronal suture that is all clearly visualized on the roentgenographic plate. The third or temporal portion of the coronal suture is free from serrations and is very compact and linear. It ends at the pterion where it meets the equally compact sphenoidal suture. This portion is rarely observed in a roentgenogram of adolescent or adult crania.

Ribbe similarly divides the lambdoid suture into three portions. The first he describes as descending four centimeters from the point of its departure from the sagittal suture and as presenting many varieties and modifications. The second portion, like the second portion of the coronal suture, is complicated and intricately serrated. The third portion begins where the second ends and runs, practically rectilinearly and compact to the asterion. When the skull structures are sagittally projected the first portion of the lambdoid suture is virtually superimposed upon the shadow of the cross section of the occipital bone, and is, therefore, roentgenographically invisible. The second portion of the lambdoid suture, like the second portion of the coronal suture, is visible in the vast majority of skull roentgenograms; whereas the third portion, quite similar to the third portion of the coronal suture and for similar reasons, can not be at all defined.

It seems to be generally agreed that in very early life the endocranial structure of the sutures corresponds morphologically to the ectocranial structure; but as age advances the endocranial aspect loses its serrations, straightens and begins to fuse, whereas the ectocranial aspect straightens to a small extent, more generally fusing without much loss in serrated structure. In reporting suture serration as observed on the roentgenogram, the notation introduced by Broca and modified by Ribbe and Zanolli may be employed. Broca, in his principles of craniologic instructions, produced a table of serrations. (See Figure 4). Ribbe says, of Broca's table: "Evidently every degree of possible serration is not represented by one of these five types; one may observe many intermediate types; but these may be easily expressed in terms of the figure immediately lower than the type to be classified, augmented by a fraction representing the degree between the immediate lower figure and the next higher." Broca also introduced a table for recording the fusion of the sutures. Ribbe uses this table, changing only the number value for the order of the fusion (See Fig. 4). In concluding his study Ribbe offers the following information relative to the order of sutural obliterations:

"In the internal table of the skull, synostosis begins at the level of the obelion and from there propagates by continuity either forwards or backwards to the asterion or to the sphenoid. The temporal sutures are the first to seal.

"The order of sutural obliteration is as follows: (1) sagittal, (2) coronal, (3) lambdoid. Occasionally, in the proportion of one time in three, the lambdoid fuses before the coronal. In the external table, synostosis appears generally in the region of the obelion among colored and in a great majority of superior races. The sagittal divisions fuse in the following order: (1) obelion, (2) vertex, (3) posterior region, (4) anterior region. The order of fusion of the coronal suture is as follows: (1) temporal, (2) bregmatic, (3) complicated division. This order is somewhat confused among Chinamen, Malays and Peruvians. The order of fusion for the lambdoid suture is as follows: (1) lambdoid portion, (2) median portion, (3) inferior portion. Near the pterion, the sphenofrontal suture closes before the sphenoparietal suture. The mastoidoparietal suture in

nearly all races is one of the last to fuse. Ossification normally appears in the external tables of superior races at about twenty years of age in the youngest and fifty-five at the very latest, averaging between forty and forty-five years of age. In inferior races these fuse between twenty-five and twenty-eight years of age. The progression of fusion of sutures is the same internally and externally, although frequently it is asymmetrical at the levels of the transversal and lateral sutures. It is in general more advanced on the right for the lambdoid, on the left for the coronal and peripterion sutures. The majority of human crania are asymmetrical.

"In young individuals the internal table of the skull shows dentations that disappear with age and fuse into the diploe."

Zanolli, in a study of the obliteration of the cranial sutures, quotes Ribbe, Testut, Tidy and Topinard, but concludes that the ectocranial construction is an insufficient criterion from which to judge the probable age of the individual, stating that the endocranial construction is more important. Zanolli further infers that the order of sutural occlusion is neither regular nor constant; that it is apparently more precocious in the male, where it becomes manifest mostly at about twenty-five years, than in the female, where it is delayed to about thirty years; and that sutural obliteration appears to be more regular and orderly in the female than in the male.

Dwight, in the study of one hundred observations, which study is, however, culled from an assortment of skulls so mixed with regard to sex and race as partly to vitiate any absolute inferences, arrived at the conclusion that the sutures begin to close at a much earlier age than had ever before been stated; that the closing almost invariably begins endocranially, although the process does not at all necessarily appear first on the outside opposite the points previously fusing on the inside; and that the time of closure of any particular part of a suture, and the order in which the process advances, are very uncertain. Dwight then offers his opinion as to the usual order for the closure of sutures, as follows:

"I think that closure generally begins in the back part of the sagittal and often as soon or nearly as soon in the lower ends of the coronals. I think that when the sutures close early the coronal usually closes before the lambdoid, but that in old skulls, on the outside, at least, the lamb-

doid is more frequently obliterated than the coronal. On the inside of old skulls there is very often a minute line showing the position of the apex of the lambdoid suture when all the others are quite gone. A persistent frontal suture is one of the last to disappear, as has been previously taught.

"As to the rules for determining the age of the skull from the condition of the sutures, it is necessary only to compare them with the observations recorded in this table to see what they are worth. It must not be forgotten that there are other guides to the age of the skull; and I am not prepared to assert that, taken together with them, the sutures are absolutely worthless in the hands of an experienced anatomist. I am sure that to anyone else the rules in question are misleading and dangerous."

Parsons and Box, in a detailed study completed in 1905, corroborate the conclusions arrived at fifteen years before by Dwight, that the closure of sutures may occur in a healthy skull before thirty, though it is rare, and, for practical purposes, the absence of any internal obliteration should fix the probable age at less than thirty. Parsons and Box further add that:

"Over thirty there is always a fair amount of obliteration of the coronal and sagittal sutures internally, while over fifty usually, and over sixty always, all the endocranial sutures are obliterated.

"The ectocranial sutures are so variable that no estimate of age should be made from them when the inside of the skull can be looked at, and the fact that so few museum skulls are opened detracts very much from the practical value of many of our great collections.

"With regard to the place at which ossification usually begins, Dwight is doubtful whether it is below the stephanion or at the obelion, though he rather favors the latter place, and other authors seem divided in their opinions. Our own evidence makes us think that somewhere in the lower half of the entocranial aspect of the coronal suture obliteration usually commences, and that this is followed very rapidly by external obliteration of the same suture below the stephanion where the temporal ridge crosses it.

"The sagittal suture seems to close internally about the region of the obelion, and soon after-

wards at its anterior part, the posterior inch sometimes remaining patent after all the rest is obliterated. There can be no doubt that the accepted statement that the suture first closes externally at its simplest part, that is, at the obelion, is correct, though this is subsequent to the internal appearance of obliteration, and is often delayed till old age is reached. Picozzo says that in the male the obelion first closes, and in the female the middle of the sagittal suture, but if he is referring to the outside of the skull all our evidence goes against this statement as far as females are concerned.

"The lambdoid suture closes later than the coronal and sagittal as a rule; this we are not surprised to find, when we remember its markedly serrated appearance. As far as the three sutures with which we have already dealt are concerned, the rule seems to be that the simpler the suture the earlier its closure, and this holds good with the speno-parietal and speno-frontal sutures, which are always closed when closure has occurred beneath the stephanion, though it does not apply to the squamous suture, which closes very late, if at all. Taking the ento-cranial closure of the lambdoid, we find that, out of twenty-six skulls below forty, it is only closed in five. After forty closure is more usual, and a careful review of our records makes us believe that obliteration generally begins midway between the lambda and the occipito-mastoid articulation, and that the upper part near the lambda closes last. On the outside of the skull the closure of the suture is later, and the upper part is often the earliest to close, thus bearing out Dwight's contention that the ecto and entocranial points of obliteration do not necessarily correspond. We have no evidence, on the other hand, that Dwight's statement, that, when the sutures close late, the lambdoid is usually in advance of the coronal ectocranially, is correct.

"In our eighty-two skulls six showed signs of a metopic suture, and the evidence of this small number shows that, as in other sutures, entocranial precedes ectocranial closure. Apparently internal obliteration begins at the lower part. It is sometimes taught, though we are unable to trace the statement to its source, that when the metopic suture fails to close

at its usual time it is the last of all to be obliterated. Our records, as far as they go, do not induce us to place much reliance on this.

"With regard to the side on which closure first begins, Sauvage (*"Sur l'état senile du Crane," Bulletin de la Soc. d'Anthropologie*, Paris, 1870) says that both in the coronal and lambdoid sutures the right closes before the left. In our records there are only two in which the obliteration has been caught in a unilateral condition, and in both these it is the left side on which it is commencing. We are in agreement with Picozzo that male skulls are obliterated somewhat earlier than female."

For purposes of roentgen ray anthropology the serration as it manifests on the roentgenogram may be reported as: None—Slight—Medium—Complex

If it is thought desirable, the standards proposed by Broca or advocated by Ribbe and others, may be used; and the qualitative descriptions above enumerated are quite sufficient if they are applied with diligent care. Only the middle portion of the coronal suture and the middle portion of the lambdoid suture are of significant interest to the roentgenologist. In normal skulls when the middle portion of the coronal suture is at all visualized with any of its serrations in the male skull the age of the subject is less than thirty; in the female less than thirty-five; and for the middle portion of the lambdoid suture, its visibility indicates in the male fifty or less years, and in the female fifty-five to sixty years. These values are based on relatively few observations and can not be considered entirely accurate; nor is it advisable that unusual care be exercised in inferring the age from the state of fusion of the various sutures by reason of the great difficulty confidently to exclude the effect of pathology on these structures.

SUTURE SYNOSTOSIS

Premature synostosis of the sutures is meant to convey that the fissures of the skull ossify before their usual or normal time. The synostosis of certain sutures may be present at the time of birth, or may set in during the first months after birth; but usually it makes its appearance at a much later period. The cause of premature synostosis is not definitely known. It is assumed that the most usual cause is a constitutional skeletal disease, particularly rachitis. Premature synostosis has been referred to as a racial peculiarity; and the conjecture has been advanced that synostosis may result from the pressure of bones that bear against each other in

the fetus during uterine confinement or at the time of labor. That uterine confinement and labor may have some influence on the subsequent shape of the skull is in part subscribed to by the findings of Mueller, who teaches that the obstetrical presentation of the child at birth casts its influence on the newborn head so that the shape remains thereafter permanently moulded according to the type of presentation. Gross irregularities produced by premature synostosis appear as a result of the fact that the skull is unable to increase in size in the direction perpendicular to the plane of the obliterated suture. Cranial deformations that arise as the result of premature synostosis have been classed by Virchow, quoted by Topinard, as follows:

1. Dolichocephaly.

(a) Median-superior synostosis; simple dolichocephaly through synostosis of the sagittal; varied or spheenocephaly, in which there is a compensatory development in the bregmatic region.

(b) Synostosis of the lateral-inferior including leptocephaly by fusion of the frontal and sphenoidal, and klinocephaly by fusion of the parietal and sphenoidal or temporal.

2. Brachycephaly.

(a) Posterior synostosis, comprising pachycephaly by fusion of the parietal and occipital, and oxycephaly by fusion of the parietal and occipital or temporal and compensatory development in the region of the bregma.

(b) Antero-posterior and lateral synostosis, comprising platycephaly by fusion of the lateral, frontal and parietal; trochocephaly, by fusion of the parietal and a part of the frontal; plagiocephaly, by fusion unilaterally of the parietal and frontal.

(c) Median-inferior synostosis: Simple brachycephaly by precocious fusion of the sphenoidal basillary suture.

Lucas has also proposed a classification introducing new terms for every eccentric shape according to the following self-explanatory denominations:

Acro-cephaly	Lepto-cephaly
Hypsi-cephaly	Trocho-cephaly
Oxy-cephaly	Megalo-cephaly
Platy-cephaly	Macro-cephaly
Tapino-cephaly	Micro-cephaly
Chamoe-cephaly	Plagio-cephaly
Dolicho-cephaly	Klino-cephaly
Brachy-cephaly	Cymbo-cephaly
Megisto-cephaly	Scapho-cephaly
Brachisto-cephaly	Spheno-cephaly
Steno-cephaly	Trigono-cephaly
Eury-cephaly	Pachy-cephaly

As Stocking so well says:

"There seems to be some confusion in the terminology used for the various shapes of heads. This is perhaps due chiefly to two causes, the first one of which is undoubtedly the fact that anthropologic interest seems to have been the most common reason for research and classification up to the present. Whereas it appears to us as being more important to physicians that what there is of clinical significance attached to the different shapes of skulls, both as to etiology and symptoms, should be the feature kept uppermost in mind.

"The second cause for confusion seems to be that too many minor details have crept into the differentiation, and the gross general distinctions have been more or less lost sight of amid the plethora of technical terms.

"It is not difficult to illustrate the confusion of terms in the various classifications by referring to the literature. In German works on the subject 'Turmschädel' has been generally used to describe a particular kind of head, for which authors in other languages have used terms less descriptive. 'Oxycephalus' is one of them. This word means a pointed head, which is by no means the commonest type of Turmschädel. Others have used the word 'acrocephalus,' the first portion of which is derived from the Greek word 'akron,' meaning top or extremity, and which we make use of in the word 'acromegaly' in reference to enlargement of the distal portion of the body. Still others have used the term 'hyperbrachycephalus,' which yet does not describe the condition as acceptably as the word 'turmschädel'."

From these considerations it appears that pathological deformations of the vault may be classed into three general groups, as suggested by Hrdlicka: (1) Scaphocephaly, where the vault is abnormally prolonged and the sagittal suture more or less resembles the keel of a boat. This deformity, which may be accompanied by an annular retrocranial depression, is due to the premature occlusion of the sagittal suture, and is particularly common among American negroes; (2) acrocephaly, or abnormal increase in the height of the fore part of the vault, due in the main to premature occlusion of parts of the coronal suture; (3) plagiocephaly, or asymmetry of the vault produced mostly by

premature occlusion of the coronal or lambdoidal suture on one side.

Scaphocephaly, said Minchin and Baer, results by reason of the existence of a single center of ossification for the two parietals; and, said Morselli, because of two points of parietal ossification. But Welcker completely overthrew these erroneous theories. Two types of scaphocephaly may usually be distinguished and are called by Topinard ordinary and annular. In ordinary scaphocephaly the median sagittal suture is lengthened and there is usually a ridge-like bulging of its entire course. Ordinary scaphocephaly may be dominantly frontal, occipital or parietal. Annular scaphocephaly is distinguished by a circular depression found immediately posterior to the coronal suture and giving the skull the appearance, when sagittally viewed, of being composed of two lobes, one anterior and the other posterior.

Acrocephaly may also occur in two distinguishable types. In the first type the skull is raised and resembles a round crown or turret (the turriccephaly or turret head of Stocking). In the second type the vault presents the appearance of a rounded bowl.

Acrocephaly is a characteristic of such peculiarity as to attract immediate attention, and may be noted in the living in those individuals of exceptionally high forehead.

Plagiocephaly may result from various causes: (1) A congenital inequality in the two halves of the cranium incident to an inequality in the cerebral hemispheres; (2) the arrested development of a particular cranial segment, as one of the cranial bones; (3) induced flattening, either intentional or as the result of infantile posture in children, as studied especially by Walcher; (4) chronic torticollis; (5) hereditary ethereal deformation derived from exaggerated plagiocephalic parent (Topinard); (6) synostosis of the coronal or lambdoidal sutures. The most common cause of plagiocephaly following premature synostosis is that due to the fusion of the coronal suture either of one of its halves or in its entirety. Fusion of the lambdoidal suture is a less common cause of plagiocephaly.

Besides scaphocephaly, acrocephaly and plagiocephaly, Topinard would include trigonocephaly, described by Welcker and Virchow as due to the congenital synostosis of the medio-frontal suture. Viewed from above, the head presents a generally triangular shape, with the apex at the forehead. In addition to these pathological deformations the non-intentional and intentional artificial deformation may be met in dealing with primitive peoples.

Hrdlicka summarizes a description of these variations as follows:

"Intentional artificial deformations, which are particularly common in certain parts of this continent and among certain Pacific Islanders, are designed shapings of the head of the new-born infant, as a result of an habitual or religious observance. They are produced by the continued application of direct pressure, by board and pad, bandage and pads, or by a bandage alone, to the head of the new-born. They are of three main classes, namely, fronto-occipital (flat-head), circumferential ('macrocephalous' or 'Aymara'), and occipital.

"The 'flat-heads' are characterized by a greater or lesser flattening of the front, a corresponding flattening of the occiput, a compensatory bulging of the parietal regions, a more or less marked depression along and just posterior to the coronal suture, and occasionally a more or less marked depression along the posterior portions of the sagittal suture. When pronounced, the last named condition gives rise to the so-called bilobed crania.

"The 'Aymara' deformations are characterized by a more or less marked, broad, circular flattening or depression passing over the frontal bone, the temporal squammæ and the lower parts of the parietals, and over the lower portion of the occipital, while the posterior and superior portion of the parietals and the upper part of the occipital protrude in a compensatory way upward and backward. Anterior to the coronal suture in these cases there is generally an elevation, while posterior to the suture we find a more or less pronounced annular depression.

"The occipital deformations resemble those produced accidentally, but in general are more marked. They may represent merely a favored and perhaps assisted incidental flattening due to the resistant head cushion, as among the Navahos and Pueblos; or they may occur, due to less effective methods, as by-products of the flat-head deformation with help of bandages, as among the old Peruvians. These deformations generally involve parts of the parietals, and may be median or lateral. They result in shortening, elevation and broadening of the vault, and in making the fore-

head both higher and more vertical."

The pathologic deformations described have as a basis anomalies in the bony metabolism of the cranial skeleton. In addition, certain deformations may arise as the result of encephalic changes, more particularly hydrocephaly and the changes incident to microcephaly.

SIZE OF SKULL

To begin with, the size of the skull is greatly dependent upon the size of the brain; although the cranial skeleton and its contents may be developed, to a certain extent at least, independently (Gratiolet reported the case of an infant in whom the cranium presented a normal conformation; but the brain was, nevertheless, almost entirely undeveloped and wanting). When, in the skull, there accumulates an undue amount of fluid, as in hydrocephaly, increase in the pressure bulges the cranium so as to augment its size; and the distribution in the lines of force of the pressure is such as to be exerted from the resistant bony base against the resilient membranous vault. If the fluid accumulates during intrauterine existence, or shortly after birth, the relatively great plasticity of the membranous vault bulges equally and radially from the bony base. It is in these cases that the median sagittal curve of the vault traced from the nasion to the inion presents a nearly perfect hemispherical projection. If the fluid accumulation begins after the membranous vault has begun to ossify, and has lost much of its initial plasticity, the pressure exerted by the increasing fluid will be spent against the parts that offer relatively minimum resistance; and since, in the infant, the anterior fontanelles and frontal region in general remain more plastic for a longer period than the posterior cranial sector, acquired hydrocephalus manifests as a bulging more prominent in the frontal than in any other region.

It will be found that in general the majority of abnormally large skulls are hydrocephalic. Virchow suggested a two-fold nomenclature for enlarged skulls, calling increases in size due to enlarged brain cephalonic, and increases due to the accumulation of abnormal quantities of cerebrospinal fluid, hydrocephalic. He further subdivided cephalonic skulls into normal and pathologic, in which the normal show a cranial base that is proportionate to the cranial vault, and the pathologic show a vault that has increased proportionately more than the base. From the roentgenogram it is sometimes possible to differentiate between hydrocephalus and cephalonia; and this differentiation accomplished, the distinction between normal and pathological cepha-

lonia can be made by the roentgen ray anthropometric study of the proportion that exists between the base and the vault (Anton and Ehrich have discussed the occurrence of cerebral hypertrophy leading to cephalonia as being in some cases a congenital affection frequently associated with aplasia of the suprarenals and with persistence of the thymus).

Hydrocephalus may be congenital or acquired. In addition to the strikingly characteristic enlargement and deformation of the skull that accompanies both congenital and acquired hydrocephalus, there are changes in the orbital roofs and also in the sella turcica, in which the latter, by pressure of the accumulating fluid, is in some instances flattened and widened. It seems that the facial cranium suffers little or no affection in hydrocephalic changes; so that the cranio-facial index, subsequently to be described, affords a means of inferring, from the roentgenogram,

the probability of cranial deformation incident to hydrocephaly.

In contradistinction to hydrocephaly the abnormally small head may be soon recognized as microcephaly.

MICROCEPHALY

Microcephaly is found in two types of subjects. In the first, the intelligence of the individual is conserved, but in the second, it is associated with idiocy or imbecility. It consists of a reduction in the volume of the cerebral mass, or of portions of the encephalon, more especially the posterior or anterior parts. In hydrocephaly the skull is characterized by relative preponderance of the vault as compared to the lack of prominence of the face; but microcephaly manifests in the reverse order, by a full and markedly conspicuous face and a diminutive vault. According to the cranial capacity Broca distinguished two grades of microcephaly which he called, respectively, true microcephaly and demi-microcephaly.

True microcephaly of Broca was associated with the smallest heads, holding a capacity of about five hundred cubic centimeters, and demi-microcephaly was intermediate between true microcephaly and normal capacity, or about one thousand cubic centimeters. True microcephaly is instantly recognized, though it is relatively uncommon. Demi-microcephaly may be so slight as to require the measure of the diameters of the skull for its appreciation; and on this point roentgen ray anthropometry affords in the living what could never before be obtained, a measure of the internal diameters of the skull. All methods for the calculation of cranial cubic contents in the living have been based on the use of the various diameters or of the cranial module without other than an estimate of the thickness of the component bones. A roentgenographic means for estimating cranial capacity will shortly be discussed in the section on measurements.



EDITORIAL

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ANNUAL MEETING

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Introducing Mr. Public Interest

STATISTICIANS have stated so often that twenty cents of every dollar earned by the average person in the United States is paid out for medical attention, that for the purpose of considering the public interest in the profession of medicine it may be accepted as an established fact. And conceding that in the term "medical attention" are included such items as drugs, nurse hire, and other incidentals which always accrue during periods of mere indisposition as well as protracted and serious cases of illness, it still would be worse than silly to say that the public is not justified in exhibiting a very substantial interest in things medical.

Such a conclusion is warranted even if the matter be viewed in its most inconsequential aspect, or what may, for the sake of brevity, be dubbed reverse economics. That is to say, even if one confines his mental processes to the barter and trade viewpoint, or the common occurrence in things commercial of buying at bargain prices, it is impossible to reach any other conclusion than that the public has an increasing interest in the fundamental problem of the public health in its relation to the social welfare.

But even in this sort of a frothy mental delirium,—which does not in any sense comport with the importance of the question,—it must not be forgotten that the public realizes its power to punish that man who demands compensation out of all proportion to the value of the service rendered. No less in the medical profession than in commercial pursuits, the mode of punishment is registered with extreme regularity, in the one case by the withdrawal of patronage, and in the other in the bankruptcy courts. Those permanent records of good citizenship recognized in every community show that pretty generally the public is able to correctly evaluate the service of every man engaged in the practice of medicine. Evidence of that fact is to be found in the social ostracism inflicted on the professional humbug who must constantly be on the lookout for fresh pastures.

The loose thinker is pretty apt to retort that all this is too complaisant a view of the matter and that its soundness is disproven by the professional mountebank and conscienceless quack who make a mighty splurge and of whom it is admitted there are more than is good for the public weal.

But the record of man's doings, taken for a period of years, shows that while the public as such may be slow to wrath it is exceedingly vengeful when seduced with unfulfilled promises and its good faith violated by men without regard for common decency.

This is the place where the responsibility of the press begins as a preventive problem. For the moment, nothing will be said about the larger measure of duty which the press owes along the lines of educational activity in the fundamentals of correct living and health matters.

Recognizing all this, generally speaking, the press, lay and scientific, proceeds with a degree of conservatism that to the extremely nervous mentality, appears almost dead from the neck both ways. There is, however, good reason behind this plan of making haste slowly. The press is a quasi-public institution. No other man-made institution is quite so amenable to the capricious tendencies of public opinion. The public exerts peculiarly drastic measures when it feels it is being hoodwinked or deliberately sold out.

It is matter for congratulation that the majority of those publications taking up the health problem do so with marked intelligence and an appreciation for the manifold intricate involvements entailed.

In the main, it is probable that the lay press strives as earnestly as does the more strictly scientific press, to discharge its obligations in the utmost good faith and intelligence, and with due respect for the social consequences of public opinion led awry by vicious publicity.

Occasionally, however, it happens that a thoroughly reputable member of the journalistic family runs amuck, and in the process, stubs an exposed toe against a familiar though temporarily forgotten fixture that has been found essential to the conduct of a decent household.

Reference is made to the well established principle that the privileges of editorial supervision and expression carry a concomitant responsibility. That is to say, the mere publication of an article anonymously involves a greater degree of accountability than is otherwise true, on the theory that thereby the publisher adopts as his own whatever statements emerge from the shroud of the hidden author.

These things are so elementary in the life of the initiate publisher and editorial staff that their restatement here may seem unnecessary.

But justification,—if indeed justification for exposition of a sound principle is ever necessary,—for such a gross malfeasance against the accepted social decorum may be found in a comparison of a discussion appearing in *Atlantic Monthly*, July issue, entitled "Osteopathy, Chiropractic, and the Profession of Medicine," written by Dr. Channing Frothingham, of Boston, with one appearing in the same issue of *Century Magazine* under the caption "Our Medicine-Men," anonymously, "By One of Them."

In passing it is no more than fair to say that Dr. Frothingham's article is a sound exposition of both the rule stated and the subject discussed, while Dr. Anonymous' disquisition proves the wisdom of the rule by violating it, and carries a marked discredit to the publication in which it appears because of the sheer disregard for logic, common sense, and proven facts.

Whether or not one agrees with the conclusions reached by Dr. Frothingham he can have no honest quarrel with so frank and impartial a treatment of the facts, and an obvious

regard for the social welfare. It is unfortunate, to say the least, as much cannot be said of Dr. Anonymous' treatment of his subject.

Before passing to more detailed discussion of the principles involved, prudence suggests two major propositions be set up in order that they may be kept constantly and definitely in view:

1. Whether the public, speaking inclusively, is actually paying too much or too little for the medical attention it demands is a relative matter, depending, first, on what the public is able to pay, and, second, on what the public actually gets for its money.
2. By and large, health is always cheap at any price, as will testify any number of persons who have lost it and are seeking to regain it; and as is further amply proven by the total dollar value of the time men and women in the United States are absent from work every year the result of sickness and disability.

Exact figures to substantiate these two propositions are available in the public records if any one desires to go into that much detail.

Prudence also dictates the statement of two minor propositions which play an important part in a sincere and intelligent pursuit of this problem. They may be succinctly stated:

1. On the whole the medical profession has never been, and is not now, a money-making profession viewed in the commercial sense. This again is proven beyond serious dispute by available statistics giving the average annual gross and net income of medical men in the United States.
2. Fundamentally, the relation of the medical profession to the general public is an economic problem, because, first, it involves the ability of men and women everywhere to do a day's work, and second, because the medical profession is controlled absolutely and mercilessly by the necessity of earning sufficient money to maintain itself and its dependents on a respectable and efficient plane, contemporary social, and economic customs considered.

Introducing Dr. Frothingham

DR. Channing Frothingham, to quote from the biographical notes found in "The Contributors' Column" of July Atlantic, is "a well-known Boston physician, is on the faculty of Harvard Medical School and the staff of Peter Bent Brigham Hospital. At one time Commanding Officer, Base Hospital, Camp Devens; at another, Chief of Medical Service, Walter Reed Hospital, Washington, D. C."

From which Dr. Frothingham's professional reputation and individual citizenship is assured. He speaks both with the authority of position and the wisdom of experience. Whatever he has to say on the subject of the relation of the medical profession to the public is worthy careful consideration. Particularly sound are his suggestions that in the intelligent exercise of the powers and privileges of licensure will be found the method by which the public can be assured proper protection against much of the fraud now perpetrated under the guise of the art of healing and science of health. And because of the importance of this phase of medical practice it seems sensible to quote excerpts from Dr. Frothingham's article and offer a few comments thereon as a part of this resume.

After traversing his subject, Dr. Frothingham concludes:

"The public should demand that all those who are to practice the healing art, in any manner, as a profession, should have a general knowledge of the established facts in medicine, and the relation of special diseases to the public health. In other words, in all the states there should be one general board of registration in medicine, and the standards established by that board should be high. With the education necessary to pass such a board, the sincere therapeutic enthusiast, be he osteopath, chiropractor, electrotherapist, faith-healer, or herb-doctor, will probably not do much harm to the individual, or be a source of danger to the public health."

Dr. Frothingham justifies this conclusion by calling attention to a fact which is obviously inimical to the public health:

"In the states in which all those practicing the healing art are compelled to demonstrate a general knowledge of disease, by passing an examination before the state board of registration in medicine, attempts are being made to have special boards of registration created for osteopathy and chiropractic, in order that those who profess them may practice their special therapeutic procedures without a thorough knowledge of disease and its diagnosis."

Proof of this attempt on the part of non-medical men to secure public recognition just comes to us from Dr. Leon J. Menville, President of the Board of Medical Examiners for the State of Louisiana. A part of Section 13 of the Medical Practice Act of that state reads:

"Section 13. Be it further enacted, etc., That the term practice of medicine, surgery, midwifery, as used in this Act, is hereby defined to mean holding one's self to the public as being engaged within this State in the business of diagnosing, treating, curing or relieving any bodily or mental disease, condition, infirmity, deformity, defect, ailment, or injury in any human being other than himself; whether by the use of any drug, instrument or force, whether physical or psychic, or of what other nature, or any other agency or means; or who shall examine any such person or material from such person for such purpose; whether such drug, instrument, force, or other agency or means is to be applied or used by the patient or by another person, or be for compensation of any kind or to be gratuitous."

Though the wording of this section is not as clearly stated as would seem desirable for the avoidance of misinterpretation and controversy, still it appears to be the intent of that law to define the practice of medicine as the employment of any method of diagnosing or treating disease. This is comprehensive and rational. But its force is nullified by another provision dividing the licensing powers of the Medical Examining Board, one section of it being the so-called regular board and the other representing the followers of Hahnemann.

Apparently for the purpose of guarding the medical profession against the assumption of a "holier than thou" attitude, Dr. Frothingham argues:

"The medical profession, on its part, should not be intolerant of the study and application of any new therapeutic agent, simply because those who advocate it present their claim with more enthusiasm than is justified by the facts, or because the advocates are not trained in general medical knowledge. It is only too well established that methods for the treatment of disease have been

taken up with enthusiasm by the medical profession, only to be eventually discarded as either useless or even harmful to the patient. Also, valuable additions to the cure and prevention of disease have been made by individuals who have not been trained in medical science. The medical profession should, therefore, take up with tolerance, study carefully, and endeavor to fit into its proper place, any new therapeutic agent that is brought forward in a serious manner."

This leads to the crux of the whole situation which ought to be perfectly obvious to the well informed layman as well as physician. That is to say, it must be recognized that the question of "isms" and "cults" will never be settled in the United States, so far as the practice of medicine is concerned, until both the profession and the public acts on the proposition, intellectually and legally, that whoever holds himself prepared in any manner to diagnose or treat diseases thereby offers proof that he has had a minimum standard of training in the fundamental subjects of anatomy, physiology, pathology, bacteriology, chemistry, etc. This would guarantee a correct basis of a working knowledge of the human body, and with this as a foundation on which to build, it would make no particular difference whether the licentiate chose to specialize in medicine, surgery, osteopathy, chiropractic, or Christian Science. In other words there could then be no more objection to a licentiate specializing in any one of the methods of diagnosis and treatment named than could be maintained with equal vigor concerning specialization in orthopedic surgery, physical therapy, or the treatment of psychic disability. By this method the sick laymen could choose his own particular kettle of fish. The science of medicine in all its phases would be applied by men properly grounded in diagnosis and treatment, and the medical profession would have discharged its obligation as sponsor of individual and national health by guaranteeing an irreducible minimum of scientific preparation.

This kind of evolution must come from within the profession outward. Otherwise the public will never be convinced that no selfish motive prompts the action of the medical profession.

Dr. Frothingham implies this very forcibly when, in speaking of osteopathy and chiropractic, he said:

"It has also been attempted to show that these professions can in no way replace the established facts of medical science; and that those using these methods of treatment should have the same general knowledge of medicine that is required of regular physicians, in order to safeguard the individual and the public health."

It is contended, in view of what has been said, that if the American Medical Association, the largest organization of medical men in the world, or the Southern Medical Association, which now ranks second in size, earnestly undertakes the achievement of this much needed reformation in licensure, the hearty cooperation of the medical profession, the better men of the other branches of the healing art, and the general public can be secured without serious difficulty.

It is gratifying that in some sections radiologists are undertaking the job of incorporating questions in roentgenology in the examination for license to practice medicine. Dr. Menville states that in Louisiana this is being done now. This is certainly a move in the right direction because roentgenology as a diagnostic aid and therapeutic agent is used quite extensively in every village and city throughout the nation. Its potentialities are becoming more evident every day, for which reason a working knowledge of radiology should be provided every physician.

Introducing Dr. Anonymous

IF you have tears, prepare to shed them now." Will Payne in "The Love of Quacks," running in the lead in The Saturday Evening Post of July 8th, provides a happy introduction.

Let him speak:

"You start down town chock-full and running over with a sense of well-being. Certainly you then want to believe that your body is a strong, dependable, automatic machine. As for indigestion, insomnia and all other bugaboos, you defy 'em to touch you! But something happens. A reckless criminal, traveling north, attempts to take a sharp turn in the road at twenty miles an hour just when you, conservatively driving south, attempt to take the same curve at the same speed. The collision rips off your mudguard. Or the trolley breaks down, delaying you forty minutes. Or an imbecile going up the station steps in front of you pokes his umbrella into your eye. Your nerves are as healthy as they were before, but they begin registering violent protests and a busy little dramatist in your skull sets the stage for a tragedy to which the whole town is invited.

"At any sharp, disagreeable disturbance the ill-bred little ego begins yammering for help and sympathy from all the world. You sympathize with yourself and sort of imagine all right-minded people as sympathizing with you. Sympathy is pleasant. So if the disturbance is prolonged you begin to find a satisfaction in your misery. When Hamlet moaned, 'O, that this too, too solid flesh would melt!' a conceited little devil on the other side of his brain was saying, 'That's a corking line, and I must be a very interesting, unusual person or I shouldn't be having these feelings!' 'There is plenty of up-to-date scientific testimony that imagining oneself ill is a quite popular pastime. For one thing it is a way of shirking and securing tender consideration from one's family and friends.'"

This sort of an introduction is quite in harmony with the conclusion drawn by Dr. Anonymous. His own words:

"The last and most important function of the physician is still his art, which consists largely in the emotional relationship he must bear toward his patients. In this all good doctors, from Hippocrates to Osler, have been proficient. This is in its nature antipathetic to the scientific attitude."

Certain words have been italicized for the purpose of suggesting the characteristics of the man and the propulsive forces inducing the trend of his thought.

If one were to follow the line of reasoning used by Dr. Anonymous to its logical and inevitable conclusion he would most certainly flounder on the proposition that the physician who could shed the most copious tears at the slightest brush with malignancy in any of its hideous forms, or could prattle the silliest nothings to women suffering the travails of childbirth, would surely become an illustrious figure in medical science, and a veritable tin god on wheels among men. But that sort of a picture does not, either in fact or theory, coincide with what history tells us about such men as Hippocrates and Osler. It is highly probable that neither Hippocrates in his clinical researches, nor Osler in his studies of smallpox, cerebral palsies of children, chorea and choreiform affections, abdominal tumors, angina pectoris, and cancer of the stomach, ever suffered from the morbid hallucination that their emotions would outweigh their scientific findings when tested in the scale of human accom-

plishment by future generations. And judging from the measure of esteem in which both these men were held by the people who lived with them, and whose illnesses were treated by them, it is incompatible with common sense to say that their humanities were either "antipathetic to the scientific attitude," or conversely, in the face of the records, that they achieved nothing of scientific value.

It would be interesting to know, for instance, how Dr. Anonymous reconciles such a conclusion with respect to outstanding figures in the history of medical science with the statement:

"The more heavily the physician leans upon the science of the study of disease, the more he is likely to neglect facts that might be directly and simply determined without an imposing and confusing array of modern gimcracks.

"The physician should be venerated not for supernatural knowledge or scientific acumen, but for his understanding of our ills and troubles, for raising his patients' morale, and, last for applying, as a technologist, the therapeutic discoveries furnished him by the small group of scientists who actually study disease."

"The function of the medical practitioner is to cure disease."

And withal, not a word of explanation as to how the research worker whom he chooses to designate as the only true scientist can hope to function intelligently, locked in his laboratory and without knowledge of either the causes inducing the pathological condition under observation, the symptoms following its incipency, or the results at various stages of its duration.

Nor is any attempt made to indicate how the physician, strictly technologist, can accomplish his function of curing disease without sufficient "scientific acumen" to understand the therapeutic agencies at his disposal and apply them according to scientific findings for his patient's welfare.

It is inconceivable that the research worker can be expected to set up a sort of multiplication table, a few problems in addition, subtraction and division, to cover every pathological condition which exists. And likewise it is hopeless to expect that the practicing physician could comprehend such a complex system even if it were possible to set it up, without pretty intimate scientific knowledge. Any one doubting this can demonstrate it to his own entire satisfaction by asking the next doctor he meets on the street to solve in his head offhand some simple problem in trigonometry or advanced physics.

So far as the practising physician is concerned it must be agreed that he cannot become a master of all the sciences which contribute to the science of medicine and find expression in the public health through its ministrations. For that reason, he shall have to become, as he is rapidly becoming, a technologist of applied science. Since the field is so large, the physician who attempts to reach proficiency in the technology of which Dr. Anonymous speaks, finds it essential to confine his efforts to a single subject—to specialize—and Dr. Anonymous on sober second thought must find himself in the peculiar predicament of the dog who tried to eat himself—the tail and the hind part could be accomplished, but the head,—well that was a problem to conjure with.

Perhaps Dr. Anonymous is mystified by a change in public sentiment—a change possibly from the ridiculous to the sublime. Hero worship no longer stands as the *summum bonum* where life and health are at stake. Magic and mystery at the sick bed have been supplanted by scientific methods. And while science, in all humility, makes no pretense of having mastered the universe, thinking men and women accept it as a great advance over the hocus-pocus procedures of the magic healers of other days.

It is against all this Dr. Anonymous inveighs. His opening statement sounds like the swan song of a broken romance; it is tuned to the funeral march of those who only chant of the golden days of long ago. It is one of those attempts to excuse sincere effort in the present to achieve something worth while because of the incomparable attainments of the past.

These are his own words:

"One of the most distressing tendencies in American medicine is the decline of the old-fashioned general practitioner, and his replacement by the modern so-called scientific physician and group doctor. The doctor is rapidly losing his important role of comforter and friend; he is no longer considered to be privy to the secrets of black magic or to derive his healing powers from intimate acquaintance with gnomes, sprites, devils, or deities. He is venerated, instead because of the growing belief that he is one of the chosen disciples of the new god of science."

In order to get a proper understanding of the decline which seems so grievous to him another excerpt from Dr. Anonymous' pen is interpolated here:

"The quarters occupied by these associations of experts are the very antithesis of the untidy, dusty, modest sanctum of the old-fashioned 'doc' of other days, so charmingly sketched by Opie Reed:

"In this professional hut there was only one window, the glass of which was dim with dust blown from the road. The furnishings of the office were less than modest. In one corner a swayed bed threatened to fall, in another a washstand stood epileptic on three legs. Nailed against the wall was a protruding cabinet, giving off sick-room memories. The village druggist, compounder of essences of strange and peculiar 'yarbs', might have bitter and pungent medicines, but old doc, himself an extractor of wild juices, had discovered the retching secret of the swamp. To go into his office and come forth with no sign of heaving was a confession of the loss of smell. Sheep-shearing fills the nostrils with a woolly dullness, but sheep-shearers could scent old doc as he drove along the road."

Compare all this if you please, with his own description of the "distressing tendencies" which make "the services of these expert super-doctors, for all the free work done for the poor, accessible in the main only to persons well endowed with worldly goods," thus placing the rank and file in a position where they "must be content with the ministrations of the more humble practicing physician, who becomes less and less the idealist of the old days, and who now represents the mediocrity whose lack of ability or personality makes impossible his attainment to the dignity of the specialist":

"Not so the offices of the modern group of specialists. Their suites of rooms are situated in magnificent office buildings. Frequently edifices of many stories are devoted to the housing of collections of stylish doctors. The central waiting-room bears little suggestion of medical affairs. It is fitted faultlessly in expensive and luxurious antique furniture. It has that 'subdued air of elegance and refinement' much sought after by those of our commercially successful countrymen who wish to shed their pristine vulgarities. Its walls are hung with portraits of famous physicians. Upon a central library-table repose neatly arranged copies of the better and more sober type of American per-

iodicals, and there is a noticeable lack of the more vulgar type of journals that diverts the moments of waiting in even the best barber-shops. Around the walls are arrayed bookcases, garnished with fat medical tomes and with endless ranks of bound volumes of medical periodicals.

"The place is presided over by a businesslike, yet discreetly sympathetic, being, usually in a uniform suggesting that of a nurse, who combines the function of reception committee with that of telephone operator and maker of appointments. The remainder of the suite, which includes consultation and examining-rooms, minor operating-room, laboratories, ateliers for radiography and photography, has the same air of scientific austerity, of efficiency, elegance, cleanliness, and expensiveness.

"It will be clear that the maintenance of an institution of this type is to be supported only at a formidable cost. The salaries of the staff and of such coadjutors as dentists, laboratory men, radiographers, nurses, technicians, bottle-washers, librarians, office girls, telephone operators, and charwomen add to the immense amount necessary for rent and equipment."

It is extremely difficult to imagine a more inane discussion of an important subject. To mention it is to dignify it far beyond anything it merits. But it affords a wonderful illustration of the fact that until the medical profession, through its recognized organizations, provides for publication sensible material on the relation of medical science to public health, stuff like this, emanating from various members of the profession, will find its way into the press. Not often, it is true, will such ridiculously reasoned and written papers be given space in reputable publications; but there are always yellow sheets aplenty which thrive on morbid propaganda, and in a case of last resort to be given audience there is better than never to have appeared in print at all.

Perhaps Dr. Anonymous' intentions were good. Perhaps too he had a just criticism concerning some one or more particular members of the medical profession who have outstripped him in professional attainment or business sagacity. But if that be the case, it is extremely unfortunate he did not choose his words more wisely and confine his discussion to the particular evils sought to be eradicated. Certainly, the medical profession is not one hundred per cent pure. If it were it would be too good for a human world. And just so long as doctors remain human beings, just that long will the profession suffer the consequences of the devilish performances of a small percentage who trample under dirty feet the ideals and obligations of as noble a profession as has ever been known in the history of mankind. This is not an attempted justification; it is simple recognition of an unalterable fact. The writer does not know how to change it. If Dr. Anonymous has any real suggestion to make he may be sure of recognition as one of the few immortals.

Foundations of Science

ANY true scientist will admit that the sole ultimate purpose of all science is the promotion and preservation of human health and happiness. The distance both in space and time between the particular thing the scientist accomplishes in his laboratory and the point at which he or some other person applies that result in order to change individual habits and social customs into more healthful and happy channels, or thereby seeks the rejuvenation and restoration of debilitated organisms,—that distance may be long and tortuous, and not easily traced. But in the last analysis, one is pretty sure to find if he looks closely enough, that whatever ad-

vance has been registered under the name of civilization or human progress, be it economic, social or physical, can be directly attributed to the accomplishments of those investigative minds seriously devoted to inquiry concerning man's relation to the universe.

Science and scientific method, in all the various functions it has catalogued and charted, constitutes man's greatest achievement. It seems perfectly sound, then, to lay down the proposition that in the great study of human life and health, so that all things may be coordinated and correlated to produce the utmost in both, will be found certain fundamental factors which are common elements to all men everywhere, and that these properly related and studied may prove to be the foundations of all science. In this way, it seems possible that through scientific effort men may lay hold of that master key which will open the door to that abundance of life referred to by Christ.

Unquestionably, these thoughts are beginning to grow in the minds of men. There is more universal interest in, and appreciation of the value of scientific achievement today than ever before in the history of the world. The quest for health and happiness has become a matter of first importance whether one arbitrarily limits his observations to some particular phase of the world's activities or studies a cross-section of the whole conglomerate mass. And attempting to visualize the future, it seems almost certain that the years just ahead will be registered in the records of human achievement as the scientific age.

If these general observations are sound, an effort to build a fair and sensible understanding of the foundations of science ought not to be utterly useless.

A few random quotations will prove interesting and instructive. They have been taken from current literature. They certainly indicate the trend of men's thought, and point conclusively to united desire to determine a starting point for all human relations,—one or two simple, absolute, fundamental principles which will stand the test of common sense and afford a rational explanation of the thousand and one things every man and woman intuitively knows he must do at his peril regardless of his eternal why?

In an article which appeared in *The Saturday Evening Post* of July 8th under the title "Food, Fuel and Smoke," Floyd W. Parsons makes this significant statement:

"From the revolving electron of the tiniest atom of matter to the blazing center of our solar system, the sun, practically everything is classified, if not valued, in terms of energy potential."

The same thought, detailed a little more, is to be found in a chapter headed "Solidified Sunshine," found in a book recently written by Edwin E. Slosson called "Creative Chemistry."

"All life, and all that life accomplishes, *depend upon the supply of solar energy stored in the form of food.* The chief sources of this vital energy are the fats and the sugars. The former contain two and a quarter times the *potential energy* of the latter. Both, when completely purified, consist of nothing but carbon, hydrogen and oxygen; elements that are to be found freely everywhere in air and water; so when the sunny southland exports fats and oils, starches and sugar, it is then sending away nothing material but what comes back to it on the next wind. What it is sending to the regions of more slanting sunshine is merely *some of the surplus of the radiant energy it has received so abundantly, compacted for convenience into a portable and edible form.*"

Without exactly knowing why, everybody realizes that life in the higher forms which constitute mankind and are useful to it neither flourishes nor exists without plenty of

sunshine. The child that is confined to the house too closely becomes first puny, second, wan, and third, sickly; and for a vigorous demonstration of the value of solar energy consult the average agriculturist about his crops during a late spring under murky skies. This may sound elemental and simple, but after all, practically all the complexities of life as it is usually lived have been introduced by man himself; for which reason it seems essential, in considering this subject, to get back to first principles.

Now listen to Professor J. Arthur Thomson, of the University of Aberdeen, Scotland, whose "Outline of Science" is one of the most lucid and fascinating treatises to be found in literature, past or present:

"Most people have heard of 'atomic energy', and the extraordinary things that might be accomplished if we could harness this energy and turn it to human use. A deeper and more wonderful source of this energy has been discovered in the last twenty years, but it is well to realize that the atoms themselves have stupendous energy. The atoms of matter are vibrating or gyrating with extraordinary vigor. The piece of cold iron you hold in your hand, the bit of brick you pick up, or the penny you take from your pocket is a colossal reservoir of energy since it consists of trillions of atoms. To realize the total energy, of course, we should have to witness a transformation such as we do in atoms of radioactive elements * * * ."

"One of the fundamental entities of the universe is matter. A second, not less important, is called energy. Energy is indispensable if the world is to continue to exist, since all phenomena, *including life*, depend on it. * * * ."

"The primary reservoir of energy is the atom; it is the energy of the atom, the *atom of the elements in the sun, the stars, the earth, from which Nature draws for all her supply of energy.* * * * ."

With these facts in mind, it is easy to explain the intense interest in things scientific. It is easy to understand the fascination and the hope men find in the study and application of the science of radiant energy. For life is a perpetual conquest. Health and happiness are its goal. These are not possible without substantial achievement and at least a meagre understanding of those forces of life man adapts to his use every day,—by which man in fact actually lives. Science seems to be the only agency known to man which offers any promise of that rational knowledge of phenomena on which certain dependence can be placed in calculating the best method of attaining his desires. Thus, with a record of useful service, a language that is common to and comprehensible by all men, it is but natural that in the great swirl of unattached thought which has pervaded the world these past few years, men should reach out for the only stabilizing influence they see.

Since all life is dependent upon or an expression of the one great source of radiant energy which man knows,—indeed one might without fear of being considered utterly foolish ask whether the two things we call radiant energy and life are not actually one and the same thing,—it may be logically stated that the science of radiant energy is really and in fact the master science, and that the principles established in its study actually form the foundation of all the other sciences. As proof of this, it is suggested that the thing which makes it possible for the scientist, be he chemist, metallurgist, or other, to change inorganic forms of life to organic, and vice versa, is that knowledge of radiant energy which enables him to separate the electrons constituting the particular thing under his hand and to rearrange them according to his will, that is, take them from one compound

and build them into another more peculiarly adapted to man's use.

The Future of Radiology

STARTING from the proposition that all life in its final analysis really is, or most certainly depends upon, radiant energy, it becomes important to determine which particular science the public can charge with responsibility for the continued investigation and beneficial application of those fundamental principles thus far discovered in the study of radiant energy. That is to say, the science of radiant energy has become of such importance that in justice to its votaries recognition should be accorded it as a noteworthy member of the scientific family. By the same token, it also becomes desirable to know whether there is already in existence any especial body or organization of scientists who can be depended upon to prosecute diligently and with fitting vision, the science of radiant energy as a possible agent for the promotion and protection of individual and national health.

This is a peremptory challenge to Radiologists, and calls immediately for a statement, in comprehensive terms, concerning the purposes of those men who espouse it. The science of Radiology, viewed in its proper relation as a factor of the public health, is asked to give an account of itself so that, generally speaking, the public may know what to expect of Radiologists, and in turn, so that Radiologists everywhere may know definitely what the public demands of them.

Therefore, stated as concisely as possible, an inclusive definition of the science of Radiology may be given as the study and application of radiant energy in all its forms for diagnostic and therapeutic purposes, confining ourselves to the medical viewpoint for the moment.

To elaborate a trifle, the science of Radiology should comprehend investigation into the curative and preventive powers of radiant energy and methods for applying them to individual and national health.

The necessity for examining briefly the present scope of Radiology in order to determine its possibilities becomes at once apparent.

According to G. W. C. Kaye, O. B. E., M. A., D. Sc., who addressed the section of electrotherapeutics, Royal Society of Medicine in February of the present year at London during the "Congress of Radiology and Physiotherapy," there are sixteen known octaves in the spectrum of radiant energy given off by the sun, and "as yet the radiologist has only turned about three octaves of these to account."

Surely this will suffice to indicate the possibilities of the science of Radiology, particularly if one compares the relative position of these three octaves in the spectrum with the wide range of electro-magnetic wave lengths familiar to every physicist. The measurement of the wave lengths of ultra violet light, x-rays, and the gamma rays of radio-active substances such as radium will be stated in Angstrom units. An Angstrom unit is 10^{-7} mm.

Ultra violet.....	4000 to 200
X-rays.....	500 to 0.06
Gamma rays.....	1.4 to 0.01

These are Dr. Kaye's figures. Some physicists contend that the range of ultra violet runs from 1800 to 8000 Angstrom units. But no attempt to harmonize those differences of opinion is essential to this consideration.

According to an American physicist of considerable note, the range of the field of electro-magnetic waves may be stated for comparative purposes with the foregoing:

25 ft. to 25 miles.....	wireless
1 / 1,000 ft. to 1 / 35,000 miles.....	heat
1 / 25,000 ft. to 1 / 70,000 miles.....	light
1 / 70,000 ft. to 1 / 125,000 miles.....	ultra violet
1 / 250,000,000 ft. upwards.....	Inf. x-rays

True, science has not yet devised methods for the clinical application of this wide range of radiant energy. But when it is remembered that the science of radiant energy as such is only about thirty years old, the phenomenal progress already made is apparent.

There is, however, one outstanding proposition that must be patent to anybody giving the subject anything like serious thought, and that is, that there is magnificent opportunity for collaborated and coordinated research by physicists and radiologists in the field of radiant energy. This is absolutely fundamental if the clinical aspect of the problem is to receive proper consideration and the therapeutic value of radiant energy be determined to the ultimate.

Bearing in mind the wonderful accomplishments already achieved in connection with the three segments of the spectrum now in use, as well as the potential promise their further investigation and application imply, one is compelled to say that failure on the part of physicists and radiologists to fully coordinate their labors in sustained and wholehearted manner will be nothing short of criminal neglect of an imperative duty. This too, without regard to the potential possibilities of the thirteen remaining octaves in the spectrum of x-rays whose clinical application should prove one of the most tantalizing and profitable tasks ever undertaken by man.

These are the thoughts which stir a man's blood when he tries to outline in visual form the future of Radiology. These are the thoughts which move a man to vigorous language when he sees indefatigable workers here and there sketching into the background of his picture suggestions of the applicability of radiant energy for stimulating subnormal tissues as well as destroying abnormal tissues. And without straining either eye sight or mental vision he begins to ask the pertinent question whether, in the no distant future, radiant energy may not be successfully applied as an immunizing agent?

Surely such a vision of the future of Radiology is not wholly beyond the realm of reason. When scientists agree that all life, and all that life accomplishes, depends upon radiant energy,—when scientists agree that disease in its various manifestations is but the breaking down of cells whose energy has been dissipated,—when scientists bring forth indisputable evidence of organ stimulation by the application of radiant energy, be it x-rays or ultra violet light,—and when radiologists themselves demonstrate every day the restorative powers of radiant energy by obliterating malignant growths and producing normal tissues in their stead,—when all these things are a matter of common scientific knowledge, is it too much to say that the science of Radiology commands respect as one of the great potential forces in national health and at the moment offers substantial ground for hope that the forces of all life may yet be scientifically understood and applied?

American Roentgen Ray Meeting

THE attention of our members is directed to the coming meeting of the American Roentgen Ray Society, to be held in Los Angeles, California, September 12 to 17, 1922.

At the St. Louis meeting of our Society, President-elect Stewart of the American Roentgen Ray Society extended to all members of the Radiological Society of North America a hearty invitation to attend the Los Angeles meeting. The undersigned begs to second this invitation, and to assure all that in addition to the profit derived from the scientific sessions, this opportunity would make a splendid vacation for those who have not yet visited the coast.

To those who are not familiar with the California climate in September, it might be well to say that the days are usually warm and the nights cool, but to reassure those who might be timid of the heat, heat prostration is unknown in California. In other words, the heat is not nearly so

enervating as that of an ordinary hot summer day in the East.

ALBERT SOILAND, M. D.

Russell Herbert Boggs, M. D.

IT was with surprise and grief that we learned of the sudden death of Dr. Russell Herbert Boggs which occurred at his home a short time ago. It will be recalled by the members of the Radiological Society that he was present at the summer meeting in St. Louis and that he seemed in his usual good health and good spirits, so his demise came as a shock to all of us.

It is fitting there should be recorded here some of the things of his life which bespeak an extraordinarily brilliant career. He was one of the leading members of the American Roentgen Ray Society, one of the organizers of the Pennsylvania Roentgen Society, a member of the Philadelphia Roentgen Ray Society and a member of the Radiological Society of North America. Not only did he hold membership, but he was very active in all of these organizations, as well as in the American Medical Association.



There are few men who have contributed so much to the literature on treatment of malignant disease as has the late Dr. Boggs. His work remains as a memorial to his industry and vision. We shall miss him at future meetings of the Radiological Society of North America and there is left a niche which no one can fill. His work is his tribute and many whom he has helped to a larger and more useful life will bear testimony to his professional ability and attainments.

We extend our sincere sympathy to the wife whom he was compelled to leave in the prime of his life.

Annual Meeting

IT is imperative that hotel reservations for the annual meeting December 4th to 8th, 1922, be made immediately. Those who contemplate attendance should write at once directly to Hotel Statler, Detroit, Michigan.

Detroit is centrally located and easy of access from all parts of the United States and Canada. From present indications the attendance will be larger than at any previous meeting of this society. Bear in mind that action at once is essential.

DEPARTMENT of TECHNIQUE

Essentials in the Use of Higher Voltage in X-Ray Therapy

EDWARD L. JENKINSON, M. D.

Chicago, Illinois

DURING the past ten months the subject of x-ray therapy has been the main topic at all meetings, both state and national. All other subjects have been displaced for the time being at least, and most of the time has been given to the subject of higher voltages. It is no longer sufficient to state the spark gap used. The potential must be definitely measured. For measuring higher voltages accurately, a sphere gap is used, constructed according to the standards of the American Institute of Electrical Engineers. The sphere gap

must be placed in the high tension circuit as near the tube as possible. By this method the peak voltage at the tube is definitely measured.

With the higher voltages the subject of protection to the patient, the operator, and persons adjacent to the department is of importance. During the past four months, numerous experiments have been carried out with special reference to protection. By the use of dental films and the electroscope the following conclusions were reached. The use of a lead screen, regardless of

the thickness, is inadequate. The idea that the rays travel only in a direct line does not apply when using a voltage of two hundred thousand or more. Secondary radiation is given off by the walls and all objects in the room. The primary rays are deflected. It is, therefore, imperative that the operator be entirely enclosed in a lead booth—this point must be emphasized. The lead must be at least one-quarter of an inch thick. One quarter of an inch of lead will supply ample protection for two hundred thousand volts. For the voltages above two hundred and twenty thousand, three-eighths of an inch should be used. It is not sufficient to line a booth with lead, as a large amount of secondary rays which are harmful to the operator are given off. By covering the lead with pulp board or leather the secondary radiation is absorbed, and ample protection is afforded.

When the large equipment at St. Luke's Hospital was installed it was, for various reasons, impossible to enclose the operator. A large lead shield with wings on each end was constructed. It was found after some experimenting that the films on the wall immediately adjacent to the tube, protected by one quarter of an inch of lead were not exposed after one hundred minutes at two hundred thousand volts with five milliamperes. The films placed a couple of feet behind the wall were very black after the same exposure with the same voltage and milliamperage. This we decided was due to secondary radiation and to deflected primary rays. The primary radiation was probably deflected by the walls of the treatment room. The secondary radiation, I believe, was given off by all objects in the room. Following the above experiments we decided that adequate protection could not be obtained by any kind of an open booth. Lead covered doors were placed at each end of the booth and the roof was entirely covered. The above experiments were again carried out and we found that films in certain parts of the booth were still exposed. Careful examination revealed a small triangular opening not covered by lead. This open-

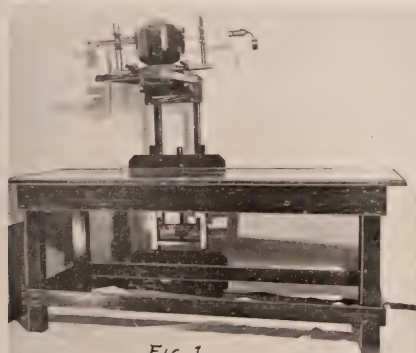


FIG. 1



FIG. 3

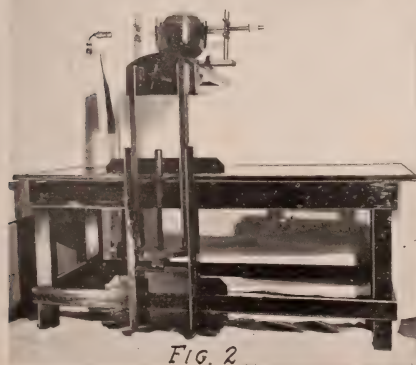


FIG. 2



FIG. 4

Figure I.—Lateral view of table.

Figure II.—Posterior view of table.

Figure III.—End view of table, showing tilting of tube.

Figure IV.—End view of table, showing lateral tilting of tube.

ing was not in the line of the direct day. The hole was immediately covered with a quarter of an inch of lead and the experiments were repeated. We then found that ample protection was given the operator.

Great care must be used in selecting the room for x-ray treatment. If possible it must be on the ground floor with no basement below. If a basement is below the treatment room ample protection must be provided for the occupants of the basement. The floor should be covered with at least one quarter of an inch of lead. The room immediately above the tube should also be considered as sufficient rays are given off the top of the anode to do great harm. We found that films placed in the room above the tube (through an air space of eighteen feet and a sixteen inch concrete floor) were definitely exposed in thirty-five minutes with two hundred thousand volts using five milliamperes. To guard against accidents and legal proceedings it is advisable to place lead on the ceiling of the treatment room. It is not sufficient to lead the walls of the treatment room head high. The entire room must be enclosed. The same thickness must be placed on the walls of the treatment room as used in lining the booth.

Using the electroscope with an air discharge of five days it was found that through an eighth of an inch of lead, the instrument was discharged in one minute and thirty seconds. It was practically impossible to charge the electroscope while the tube was excited. After the addition of an eighth of an inch of lead, the electroscope was not influenced when the tube was active.

The possibility of using a brick wall as protection against short waves of x-ray was very thoroughly investigated. It was found that through a fourteen inch brick wall the electroscope was discharged in twenty minutes. Dental films placed on the wall were fogged at the end of four hours. Through two fourteen inch brick walls and an air space of nine feet, the electroscope was not affected. Dental films likewise showed no fogging. Taking the above experiments into consideration, the following conclusions were reached:

1. One quarter of an inch of lead is the minimum for protection against two hundred thousand volts.
2. The operator must be entirely enclosed in a booth lined with one-quarter of an inch of lead.
3. The treatment room must be lined with at least one-quarter of an inch of lead.

For the comfort and well being of the patient, the treatment room must be well ventilated. The aeriols should be of copper tubing at least seven-eighths of an inch in diameter. The joints should all be rounded, which tends to lessen the amount of corona. The use of wooden cradles placed over the patient adds greatly to comfort. The cradles can be covered with lead. A portal through which the patient can be treated is cut in the lead.

The older tube stands and tables are unsatisfactory for present day therapy because the metal parts are too close to the tube and serious accidents are very likely to occur. The proper placing of the filters is of great importance from an economical standpoint. If the filters are placed less than three inches from the tube a puncture usually occurs. Therefore, from an economical standpoint it is very essential to have more than three inches of space between the bowl of the tube and the filter. We have for our use in therapy a wooden table with a wooden tube stand attached. In the making of the table no metal was used. The tube stand is very easy to operate, and any angle or position can be obtained. An electric push button is placed in the patient's hand by which she can signal the operator. (Figures 1, 2, 3 and 4 show different position of the table and tube stand).

Every treatment should be supervised by the roentgenologist (physician) in charge. The leaving of treatments to technicians is bad practice. A thorough knowledge of anatomy and pathology is necessary in roentgen therapy. It is not sufficient to place the tube above the patient and throw the switch. There are other requisites. The tube must be accurately placed with reference to the pathology. The glands and areas in which metastases are prone to occur should also be radiated. Only a comprehensive knowledge of anatomy and pathology makes good roentgen therapy possible.

The placing of the filters and measuring the target skin distance is the duty of the roentgenologist. The roentgenologist should see that the filters are *in situ*, and sign the treatment card to that effect. The measuring of the target skin distance may, to the average individual, seem of little import; one or two inches may seem of little consequence, but after working with the ion-touquantimeter with reference to the skin depth dosage, I have been impressed with the importance of the above factors.

In our work we found that changing from twenty to twenty-two inches caused a difference of 4.5% at a depth of ten centimeters. If four areas had been anticipated, the tumor mass would be receiving eighteen per cent less radiation at twenty inches than at twenty-two inches. Eighteen per cent in some cases may be the deciding factor. We can readily see how important it is to be accurate. After establishing the ratio of skin to depth dosage at a certain skin distance it is imperative that the factors be constant if results are to be obtained.

Before treating a carcinoma of the uterus or of the breast, the thickness of the part should be measured. We have found that through an abdomen measuring 14.5 centimeters, 32.5% of the skin dose was delivered through the posterior surface. Immediately we can see that two portals will not give favorable results. If we give an erythema dose anteriorly 32.5% will be delivered to the skin posteriorly. If we repeat the dose posteriorly the skin front and back will have received 132.5%. With this knowledge we can see that at least three portals of entry must be used. We can safely give 70% of the erythema dose in front, which will deliver 35% at a depth of ten centimeters and 22% posteriorly. The same dose may be repeated posteriorly; 70% will be delivered at ten centimeters and the skin will have received only 92%. To build the dose at ten centimeters, up to 100 to 115% portals laterally may be used. By this method it is possible to get 100% of the erythema dose at a depth of ten centimeters and still preserve the skin.

There is a considerable difference in the amount of obstruction that certain parts of the body offer to the rays. Take for example a chest that measures twenty centimeters through, and an abdomen also measuring twenty centimeters. What will be the difference in the depth doses? Through the chest we were able to deliver, at twenty centimeters, 23% of the skin dose. Through the abdomen, however, only 13% could be delivered at a depth of twenty centimeters, showing a difference of about 9.5%.

In obtaining the above data, paraffin and water phantoms were used. The paraffin, when compared with the human showed a difference of one in fifteen, or approximately 7% less than the body resistance. The water phantom was about 99% accurate. The measurements through the abdomen and chest were made on patients and this is the most accurate method.

NEW EQUIPMENT

The Victor Ultra Violet Hospital Unit

TO those who have devoted studious attention to ultra violet therapy, there must have been felt an obvious need for an equipment that embodies modern engineering advances in a compact, mobile form useful for hospital, clinic and cubital office practice. This is realized in the newly introduced Victor Hospital Unit, in which the distinguishing features may be summarized as follows:

- (a) Modern "Uviarc" tungsten anode quartz tube, water cooled type.
- (b) Automatic water-circulating device, including an amply

large tank, a motor driven pump, and a cooling dome, the water circulation beginning with the throw of the operating switch.

- (c) Compact assembly of equipment into an efficiently proportioned mobile cabinet holding built in drawers that accommodate a complete set of applicators and accessories.

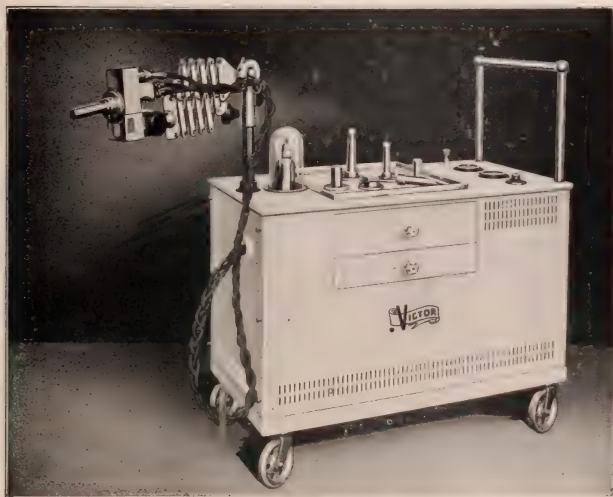
Remembering that the energy emitted by the Water Cooled outfit is of dominant bactericidal utility, it is appreciated that this unit is particularly

fitting for the clinical use that it is intended to supply. It interests the specialists who have infection pathology to treat; urologists, gynecologists, ear nose and throat experts, orthopedic surgeons, general surgeons, dermatologists, dentists.

Perhaps the most significant feature of the unit is resident in the fact that it represents the first American innovation in the supply of modern ultra violet equipment created in response to the requisites dictated by intensive research in three fields of endeavor:

- (1) Biophysical research.
- (2) Critical analysis of clinical need.
- (3) Preeminent engineering acumen.

Biophysically, the energy derived from the Water Cooled equipment, as compared to that derived from Air Cooled equipment, has been found to manifest certain qualities that have never before been ushered into medical use and this new unit embodies the essential electrical engineering factors necessary to insure the maximum yield of these peculiarly endowed rays. It is difficult to imagine an energy more uniquely adaptable than ultra violet in its extensive horizon of clinical applicability; and, offered for use in a manner that reflects the combined intellect of an army of modern workers, it is fair to predict that there will be a new era of therapeutic possibility stimulated by this latest device to supply, with maximum clinical efficiency, the most chemically potent region of the electromagnetic energies.



Buck X-Ograph Cassette

THE Buck X-Ograph Company of St. Louis is introducing a new cassette especially adapted for use with plate tunnels and Potter Bucky Diaphragm. The outstanding thought in its construction was to secure good contact without the assistance of the weight of the patient bearing down on the front of the cassette.

Since the advent of the Potter Bucky Diaphragm there has been a great deal of talk regarding the use of various kinds of flexible pads, etc., placed be-

tween the cover of the cassette and the intensifying screens in order to secure proper contact between the screens and the film. The purpose of such pads was to cause the screens to conform to the curvatures of the sheet aluminum front of the cassette, which in most instances was inclined to bulge outward away from the screens.

The Buck cassette has a sheet aluminum front drawn by machinery and clinched over the frame in such a manner as to make it absolutely rigid.

The cover of the cassette is then manufactured with ribs running both lengthwise and crosswise, which serve to strengthen the cover, making it also rigid. And by placing the screens between the two flat surfaces formed by the sheet aluminum front and the cover it does not require any unusual pressure or pads of any kind in order to get even contact between the screens and the film.

The re-enforcing ribs on the back of the cover act as studs to carry the

weight when the patient rests on the cassette, thereby relieving this strain from the stretched aluminum front. This construction makes it possible to produce a cassette which is much thinner.

The edges are perfectly smooth, and although this cassette has leather hinges they are so combined with metal plates as to overcome the disadvantage of the screens grinding together on opening and closing the cassette, all of which are conveniences very much appreciated by the roentgenologist.

New Sweetbriar Intensifying Screen

AN announcement that will be of especial interest to radiologists and others employing intensifying screens, comes from the Sweetbriar Laboratories, Inc., of Pittsburgh, Penn.

Sweetbriar screens have been generally recognized as being free from grain. This result, in the past was accomplished by sacrificing something of speed.

It has been known for some time that the Sweetbriar Laboratories were conducting a long series of research experiments for the purpose of developing a process which would give the usual high result in grainlessness, and at the same time make up the deficiency in speed.

The Sweetbriar Laboratories now authorize the statement that these experiments have developed into dependable processes which produce an intensifying screen that is absolutely grainless without any loss of speed. This statement is made with due regard for the fact that a screen may be so nearly grainless no visible effects appear on radiographs made with it, but that nevertheless there may be just that small amount of grain which obscures fine detail and outlines which should be sharp and distinct. It is stated that pictures made with the new Sweetbriar screen are clear-cut, have wonderful contrast, and at the same time show an amazing amount of detail in both bony and soft tissues.

It will be remembered that in the Fall of 1919 at a meeting of The American Roentgen Ray Society, held at Saratoga Springs, New York, the Sweetbriar Laboratories exhibited a waterproofed intensifying screen. The method then used produced a screen so deficient in speed that the Sweetbriar Laboratories refused to put it on the market. A long series of experiments has perfected this waterproofing process with no loss in speed, and unless otherwise specified by a customer all screens shipped in future will be waterproofed.

New machinery has been installed at the Sweetbriar Laboratories and pro-

duction on a large scale is now in progress in order to meet the demand.

Acme Magnetic Sphere Gap

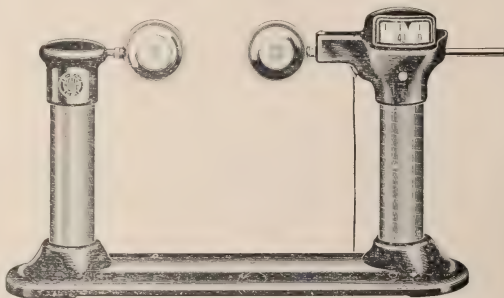
THE perfecting of the Acme Magnetic Sphere Gap by the Acme X-ray Company of Chicago, has just recently been announced. This gap is something entirely different from the ordinary sphere gap and will no doubt attract much attention among those interested in roentgen work. It is very simple to operate and eliminates all personal error.

When the potential across the x-ray tube is to be measured, a cord is pulled which causes one sphere to move slowly

the indicator will retain its position as long as the cord is not released. As quickly as the cord is released, the ball and indicator both return to their original positions.

The scale has large black figures on a white background and is easily read at a considerable distance. It is calibrated in kilovolts (crest or peak values) in accordance with the present practice.

The gap is arranged for use with the new Acme 85 kv. Corona Proof



toward the other. Traction is kept on this cord until a spark passes between the spheres. However, it is not necessary to read the gap at the exact instant the initial spark passes, as this gap is provided with a magnetically controlled indicator which is released when the spark first passes and indicates on the scale the point at which this occurs. If one keeps pulling the cord the scale will continue to move, but the indicator will move with it and still show the original reading. One can, therefore, read the gap at leisure, as

Roentgen Generator (120 kv. peak value) equivalent to seven and one-half inches, or for use on a circuit of 170 kv. (peak value) equivalent to twelve inches. It can be mounted either on the transformer cabinet or in the overhead system.

This gap fills a very important place because it combines the convenience necessary for fast routine work with the accuracy which is so essential in handling a therapeutic and diagnostic agent of such importance as x-rays—something not heretofore attained.

Liebel Flarsheim Dynelectron

IN view of the increasing use of high frequency apparatus due to the growing recognition of the advantages of electrotherapeutics considerable interest naturally follows the introduction of new appliances such as that designed and marketed by The Liebel-Flarsheim Company of Cincinnati as its Model "P" Dynelectron.

An outstanding feature in the design of this apparatus is the total absence of Leydin jars or salt water solutions, external means for cooling the spark gap, breakable glass condenser plates, and no oil to spill or seep out of the transformer.

In order to overcome the difficulties in operation of spark gap that have been more or less universal, particularly those due to corrosion and oxidation of the points as well as the overheating of the points of the gap, The Liebel-Flarsheim Company has reduced the electrical resistance of the spark gap as much as possible and provided an extraordinarily large radiating surface. Mr. Liebel, President of that Company, says this apparatus can be operated continuously within safe temperature limits twenty-four hours a day if necessary without any injury to the parts of the machine.

While this particular piece of apparatus is designed for electro-coagulation purposes suitable for the requirements of the specialist in Radiology and provides Oudin current and auto-condensation, it is so constructed that a powerful diathermy current can be produced by it.

from one room to another and to different parts of a ward in a hospital. The cabinet is constructed of oak, dark finish; the switchboard of marble embedded in felt. The spark gap is three stage tungsten point, quenched gap.

Modalities — electro-coagulation of very high frequency with sufficient

course, that there is some danger of shock, both to operator and patient, when using fluoroscopes in the dark, especially those equipped with small transformers without rectifiers. This being true, this new piece of apparatus would certainly seem to be a decided forward step in the construction of fluoroscopes.

A side view of the Wappler Fluoroscope is shown in the accompanying illustration. It consists of a wooden top table with wooden legs, which latter are strengthened with metal side rails. Between these metal rails, suspended from the shutter carriage, is the transformer and radiator type tube. The high tension terminals are on top of the transformer connecting directly to the terminals of the tube. The shutter carriage runs on ball bearings on the upper rails. These side rails and the metal rods supporting the transformer protect the patient against shock resulting from contact with high tension parts, particularly when the operator accidentally places a foot on the lower rail. The entire arrangement, running with extreme ease, makes it possible to cover the entire table top and thus permits examination of the entire body without the necessity of moving the patient.

The electrical control box equipped with the well known Wappler Stabilizing feature, auto transformer, filament control, switches and pilot light, is mounted on the side of the table; the control device for the shutter and the device for adjusting the screen to various heights from the table top are all mounted on one side of the table so that an extremely easy control and manipulation of the electrical part and the screen are obtained. The inlet connection is made to the control board and the current is switched on with a foot switch. There is, therefore, no high tension current carrying wire or terminal outside of the rails of the table and all possibility of shock or short circuiting to the operator or the patient are positively eliminated.

Another new development in this apparatus is represented in the new type screen holder, which, while fully balanced in every position, is easily adjusted for all possible tilts and movements desirable for fluoroscopic work. For the convenient placing of bed patients or possibly stretchers upon this table, the screen arm can easily be removed or turned to the side so that of all apparatus of this type, this is probably one of the most flexible, most easily adjusted, and safest. The size of the fluoroscopic field extends over the entire length and width of the table and there are no projecting parts. No accessory apparatus is required.

This is an added advantage in that the value of diathermy in various conditions, such as bone and joint pathology, is becoming quite generally recognized and used.

The Model P Dynelectron is also furnished mounted on a cabinet so that it can be readily and easily moved

power for all cases. Oudin high frequency current for vacuum or non-vacuum electrodes. Diathermy up to 4000 ma.; auto-condensation up to 1000 ma. Meters are interchangeable, one reading up to 1000 ma. and the other up to 4000 ma.

A full line of accessories is also available.

The New Wappler Junior Horizontal Fluoroscope

FURTHER attempts to eliminate all possible danger in the use of x-ray apparatus are responsible for the development of a new type horizontal fluoroscope by the Wappler Electric

Company. Because of its outstanding features of simplicity in construction, efficiency and safety of operation, this apparatus is attracting considerable attention. It must be remembered, of



The most distinguishing features of the Wappler Junior Horizontal Fluoroscope are:

1. Absolute protection against high tension shock.

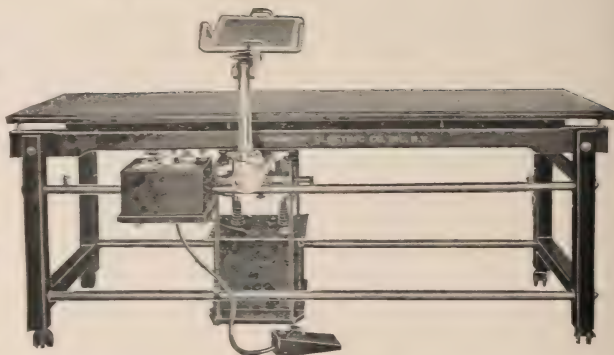
2. Extreme ease of control, operating entirely on roller bearings.

3. Full length and width of fluoroscopic field to enable complete examining of the patient without moving the patient.

4. Complete electrical control of tube current and voltage, independently of each other, and the practicability incident to being able to connect the apparatus to any existing light socket.

5. Improved screen and shutter holder to permit absolutely free adjustment of the screen for all possible conditions.

6. The screen arm removal feature



so that operations can be performed on the table without interference of screen arms or other projecting parts of the apparatus.





ABSTRACTS *and* REVIEWS



A Review and Classification of Bone Sarcomas. James Ewing, M. D., *Archives of Surgery*, 4:485, May, 1922.

TO designate a bone tumor simply as round, spindle, or giant cell, is quite inadequate to the proper definition. If properly defined, e. g., "osteogenic sarcoma," further designation of cell type is then useful as an indication of the degree of potential malignancy. Such a classification is possible to a considerable extent.

The forms of neoplastic disease originating in bone and bone marrow are classified under the following main heads which are further subdivided: (1) osteoma, (2) chondroma, (3) endothelioma, (5) benign central giant cell tumor and variants, (6) osteogenic sarcoma, (7) myeloma. Pure myxoma is classified under chondroma.

There follows in the original an "outline of the clinical, anatomic, and structural features of some common bone tumors" which covers forty or more pages. In this outline the typical roentgen ray findings are described.

Solitary diffuse endothelioma is remarkably susceptible to roentgen ray and radium but the final outcome of this treatment is not yet established. In these cases amputation should be withheld until its indications are very clear.

Benign central giant cell tumors roentgen ray or radium, though curettage holds the danger of infection and recurrence is common after this form of treatment. They will respond to x-ray or radium but months of treatment are required with restriction of motion. If of catilaginous origin they "should be susceptible to radium or x-ray" because they are cellular, but this is not definitely claimed by the writer. In uncomplicated giant cell tumors roentgen ray or radium is the treatment of choice—external radiation being preferable.

In general roentgen ray or radium is recommended for myelomas and diffuse endotheliomas but not for osteogenic sarcomas—for these latter extirpation followed by postoperative roentgen or radium treatment is favorably regarded.

Regarding this the writer makes these observations: (1) "It has been shown that it is possible to deliver an effective dosage to all parts of many osteogenic sarcomas when the tumors are accessible from all sides. (2) The

histologic changes demonstrated show a slowing of rate of growth of the tumor cells by which they are induced to lay down calcific material or dense hyaline stroma or bone. Hemorrhage and necrosis may be produced with vascular cellular tumors. (3) Cellular tumors without much intercellular stroma may undergo completet resolution and disappear," otherwise the most to be hoped for is sclerosis or ossification of the tumor tissue with cessation of growth. True osteogenic sarcomas usually prove fatal under any form of treatment.

Present results in the treatment of bone sarcomas are far below a reasonable standard. The author believes that the present state of knowledge together with the resources offered by x-ray and radium demands that the whole subject of prognosis and treatment should be reopened. More radical diagnosis, he believes, would lead to less radical treatment—nonoperative treatment is the goal to be kept in view.

As to technique he makes the general observation that no person who is inexperienced should attempt to deal with bone tumors. Proper selection of cases, more careful study of the exact anatomic condition to be dealt with, adopting the agents to the conditions as found, and a judicious combination of surgery with roentgen ray and radium will lead to greater efficiency.

This Upon the Subject of Radiographing the Spine and the Pelvis. H. J. Suggars, M.S.R. (Awarded the President's Prize.) *Arch. Radiol. and Electroth.* 26:382, May, 1922.

THE details involved in taking radiographs are listed under (a) those to be attended to before the patient occupies the couch, (b) while the patient occupies the couch, (c) those carried out afterwards.

Under the first topic the points which contribute to a good plate, such as care and cleaning of apparatus, tube adjustment, condition of tubes and provisions for the patient's comfort, are taken up. Proper cleaning prevents wear and tear upon nerves as well as machinery. Hints on how to get the focal spot as near as possible to the center of the aperture in the shield are given, and examination and alteration of the resistance of the tube before the patient takes his position is advised.

While the patient is on the couch precision in adjustment of the tubes, correct posing, and exactitude in locating the plate are essential points of good technique. Personality, pads, cushions and sand bags are all factors in producing ease and fixity of position of the patient which in turn are important factors in securing good results.

Beautiful photographic radiographs taken without due regard to the exact relation of the patient and plate are of small value. Posing is the most important factor of all and this and the matter of plate adjustment is gone into in complete detail for radiography of the pelvis and the lumbar, dorsal, and cervical vertebrae.

Details of developing and printing occupy a page. Careful immersion so that the solution flows immediately, evenly and gently over the plate is absolutely essential to desired results. Masking of the plate before printing will secure a white margin, and it is also a means of improving the appearance of a "lop-sided" radiograph if such is inadvertently made.

Sarcoma of the Long Bones. Jas. W. Gibbon, M. D. *Virginia M. Monthly*, 49:142, June, 1922.

SARCOMATOUS tumors of the bone marrow are classified by Ewing as: (1) osteogenic sarcoma, (2) giant cell sarcoma, (3) myeloma, (4) endothelioma, the last two forms being rare.

Osteogenic sarcomata are in turn classified as:

1. Fibrocellular or periosteal sarcoma. Tumors of this type arise from the inner layer of the periosteum and vary in consistency in different tumors.

2. Telangiectatic bone sarcoma, central osteogenic sarcoma, bone aneurysm, and malignant cyst are all terms denoting the same tumor, which arises in the medulla or the marrow canal and develops from the fibroblasts. They present enormous vascularity but there is no great bulk of tumor tissue.

3. Sclerosing osteogenic sarcoma. This tumor may be periosteal or central and it produces much dense solid bone.

Generally speaking there is a great variation of structure in the osteogenic sarcomata, depending upon the differentiation of the fibroblasts.

Benign giant cell sarcomata occur principally in the marrow cavity of

the long bones and cause an absorption of cancellous bone. There is seldom invasion of the soft parts and metastasis never occurs in this type. Failure to differentiate this lesion from malignant central sarcoma has often led to needless amputation.

Myceloma is a specific malignant tumor of the bone marrow.

Endotheliomata require rigid elimination of outlying primary foci. As a primary lesion they are very rare.

Diagnosis is the real problem and like other malignancies the cases often come too late to the physician's attention. Invariable pain in a bone calls primarily for an x-ray examination. Too often in malignancies this pain is attributed to "rheumatism," etc.

Coley and Bloodgood both agree that pain is the first conspicuous symptom of bone sarcoma; swelling, pathological fracture and impaired function are later symptoms. There is never muscle spasm and atrophy, as in tuberculosis.

Periosteal sarcoma well developed is recognized by a dense shadow about the shaft of the bone, sharply localized with trabeculae of new bone formation radiating outward from the shaft to the tumor. In central tumors a benign lesion in the marrow cavity may give rise to difficulty in interpretation. In central sarcoma there is an area of marked absorption in the end of the bone, its limits abrupt, the cortex thinned out but not expanded. In the giant cell sarcoma expansion of the cortex is usually marked and there is a characteristic mottling in the area of rarified bone. Generally speaking the prognosis for any form of bone sarcoma is bad. The great variation found in these tumors renders diagnosis extremely difficult and because the verdict may have such far reaching consequences to the patient no amateur should rely upon his own judgment of bone sarcomata.

When amputation is necessary, as it is in most periosteal forms, exarticulation is seldom necessary. The hopelessness of any form of treatment has led to the trial of more conservative methods on the part of some workers. Coley uses mixed toxins, sometimes combined with radium, and he reports some cures from this form of treatment. Radium alone is not effective.

For the central group treatment is about the same and results are not much more satisfactory.

A Peculiar Characteristic Metatarsal Disease. H. J. Panner, M.D., *Acta Radiologica*, 1:319, April, 1922.

THE roentgen picture of this peculiar disease shows that without doubt

the starting point is the capitellum metatarsi. There is more or less flattening of the distal surface of the joint and the structure of the epiphysis shows some changes. Later on, growing condensations and irregular rarefactions occur. "Arthritis-deformans-like alterations may appear in the joint as well as thickenings of the diaphysis." The head of the joint may become more or less deformed but the structure of the bone will finally become normal. Atrophy of the bones of both metatarsals concerned or of any other bones of the affected foot was only once observed throughout the thirteen cases studied. The progress of the disease, as a rule, presents symptoms too slight to receive recognition and thorough treatment is not often necessary. When it is it usually consists in sparing the affected foot in every way. Thyroidin may hasten the cure. Operative treatment is rarely needed, and never needed in the younger patients.

Koehler and others have had experience with such cases but only Koehler has closely considered them and the author believes Koehler has seen them only in the latter stages and has not therefore observed, as has the author, that the origin of this disease always occurs before the growth is complete.

The author and Koehler agree that the disease is not caused by tuberculosis, syphilis, or osteomyelitis, but they differ on the view that arthritis definitely localized here is probable. The author believes that it sometimes is thus localized.

Also he believes that there is a relationship between this disease and Calve-Perthes' hip disease—their whole clinical courses being similar to each other and the roentgen picture showing points of similarity, e.g., origin in the epiphysis with flattening, more or less widened joint fissure, etc.

The Examination of the Teeth in Group Medicine. Boyd S. Gardner, D.D.S., *Mayo Clinic, Minnesota Med.* 5:356, June, 1922.

THE necessity of roentgenographical examination of the mouth is "not entirely appreciated either by the medical or dental professions. Certain members of both professions still consider it quite ridiculous" to make such an examination providing the patient is wearing a full upper or lower denture. However, this examination is necessary and is due the patient suffering from a systemic condition wherein a focal infection is suspected.

There are many advantages in checking up the clinical and roentgen ray findings at the same time. Full

mouth roentgenograms make comparison with the normal possible. Residual roots and granulomas, impacted and unerupted teeth are often unexpectedly revealed in the course of a thorough examination.

Extraction is discussed in its general aspects. Alveolotomy carried out with proper restrictions gives satisfactory results and should not be condemned unqualifiedly. Extraction alone is not sufficient to eliminate oral infection and dentists should make a report of dental findings to the physician whose responsibility has not ended by simply recommending extraction. It is the duty of the dentist to decide whether local conditions require extraction and the duty of the physician to decide whether systemic conditions warrant it, and co-operation between both professions is earnestly to be sought.

Research Institutes and Their Value. Francis Carter Wood, M.D., *Science*, 55:657, June 23, 1922.

THE following is an abstract of an address delivered by Dr. Wood at the opening of the new laboratory of the Collis P. Huntington Memorial Hospital, Harvard University Medical School. The laboratory is equipped for research in the field of biophysics.

The thinker must work out his great achievements protected from interruption and annoyance and apart from the general current of existence. This is one reason why the garret and sometimes the cellar has witnessed the birth of many a great discovery.

However, the garret plus sealing wax, some wire, a few pieces of broken glass—and brains, no longer suffices. Brains plus equipment of great delicacy and cost are absolutely essential today, as also is organization and classification of research problems, together with a higher degree of collaboration among scientists than has even before existed.

Had this laboratory been earlier at the disposal of the "brilliant group of physicists, under the leadership of Professor Duane, have made so many important advances in the theoretical study of x-rays" it is very likely that the recent practical triumphs in this field which now are credited to continental workers might instead have originated in America.

"The world will profit by the investigations which in the future will be made in this laboratory for * * * the modern scientist gives freely and at once to the public everything he achieves. * * * The true investigator's chief stimulus is love for his science" and, whether or not the cancer foe will be routed by research at Har-

ward or elsewhere, true men of science at Harvard will put forth their entire effort in a noble and brave attack.

The Value of Roentgen Therapy in Dermatology. George M. Mackee, M. D. and George C. Andrews, M. D. *Am. J. Roentgenol.* 9:241, April, 1922.

THIS is a useful paper naming eighty diseases and conditions of the skin amenable to roentgen therapy. These are grouped into thirteen divisions according to susceptibility to roentgen therapy and results obtained with other forms of therapy.

The Roentgen Ray Treatment of Diseases of the Skin. H. H. Hazen, M.D., *Am. J. Roentgenol.* 9:247, April, 1922.

DR. Hazen gives specific results obtained upon private patients, using MacKee's technique. He states in conclusion that the roentgen ray is the most useful single therapeutic agent possessed by the dermatologist, being of the greatest value in both malignant and benign tumors, keratoses, warts, eczema, acne, lichen planus, some forms of tuberculosis, syphilis and folliculitis of the back of the neck, tinea tonsurans, tinea barbae, some cases of pruritis, granuloma annulare and mycosis fungoides.

X-Ray in Dermatology. C. Augustus Simpson, M.D., *Virginia M. Monthly*, 49:122, June, 1922.

THE author divides the history of radium therapy into three eras: the optimistic, pessimistic, and the realistic. It is as unfair to judge the roentgen ray therapy of today by that of ten years ago as it would be to judge the surgery of today with pre-aseptic surgery. Ten years have wrought wonders and the future decade promises wonders surpassing the present ones.

The scope of the science has so widened that therapy and picture work he believes should be in charge of different operators using separate and special x-ray machines and tubes.

Roentgen sickness he believes is on the verge of its elimination through the study of blood and tissue chemistry. The biological aspect and importance of x-ray research is discussed.

In the specific discussion the writer states that he considers the roentgen ray to be the greatest single therapeutic asset ever placed in the hands of the dermatologist. Accurate dosage and diagnosis are essential and some telling illustrations of harm wrought when these two factors were at fault are given. The age of hocus-pocus, the writer states, is passed and the time is

near at hand when "some physicians must either give up roentgen ray therapy or else devote enough time and energy to the subject to master it" and he adds that the same is true of radium therapists.

Not all skin lesions can be cured by the roentgen ray but many are almost entirely dependent upon it, for example, acne pruritis and certain types of eczema. The cure of a well developed eczema, however, is a matter of graver concern to the roentgenologist than is that of an uncomplicated skin cancer. Simple syphilis, lichen chronic simplex and lichen planus are easily cured as is ringworm. In Paris and London where the former prevalence of ringworm led to the establishment of "ringworm schools" for the isolation of the children so afflicted, roentgen ray treatment has led to the abolishing of these schools where formerly thousands of children were segregated.

Besides the lesions mentioned the following ones are benefited by roentgenotherapy: favus, blastomycosis, actinomycosis, dermatitis seborrhoeica, psoriasis, prurigo, granuloma fungoides, leukemia cutis, Hodgkin's disease, various forms of cutaneous tuberculosis and scrofuloderma, lupus, warts, leukoplakia, Kraurisis vulva sarcoma (Kaposi), and Paget's disease.

In acne sometimes the Kromayer and Alpine lamps are superior to x-ray as curative agents but usually they are used in conjunction with it. It is not claimed that the x-ray is the sole therapeutic agent in many of the less common dermatological lesions but it is claimed that it is of inestimable value if used in conjunction with other therapeutic measures and that it is the dermatologist's greatest single asset.

Modern Treatment of Cancer of the Lip. Henry K. Pancoast, M. D., *Surg. Gynec. Obst.* 34:589, May, 1922.

THE radiologist in his effort to solve the problem of malignancy needs the aid of the physicist, biologist, pathologist and surgeon. In some measure he has been successful where surgery has not, but there is still much to be done, and also much impossible of doing.

At the present time preventive measures, surgical procedures and non-surgical methods are the agencies by which cancer is treated. Preventive measures have a greater field about the mouth than elsewhere.

The non-surgical agencies for combating lip and mouth cancer are radium, the x-ray and electrothermic coagulation, and possibly the cautery. The essential purpose of this paper is

the presentation of the present status of these agents, and surgery is touched upon only as it is incidental to the discussion.

Theoretically all lip cancers should be readily cured by surgery but they are not for the reasons that patients, as a rule, do not present themselves early enough in the course of the malignancy, and that surgery does not always remove all of the cancer.

From the standpoint of methods of treatment, prognosis and statistics, the general run of cases is classified in three groups: "Primray lesions without evidence of metastasis; cases presenting small palpable nodes in the submental or submaxillary triangles; and those with advanced primary lesion and large nodes in these areas or in the gland group."

Thorough knowledge of the anatomy of the lymphatics is requisite in any form of treatment. In the first group above, surgery is admitted to give good results but the author does not regard it as a complete method of treatment and he advocates pre-operative treatment as well as postoperative treatment. The author himself treats such a case by electrothermic coagulation of the primary lesion; healing takes place within two weeks to a month after this whereupon radiation of the neck is administered once or twice.

For the second group postoperative radiation is refused unless pre-operative radiation has been given as the malignancy does not respond well otherwise and the radiologist is too often given undeserved censure. The writer's method with this group is exactly the same as for the first group. If the enlarged glands do not subside radium implantation or block dissection is then used and is followed by postoperative treatment. The author does not wish to go on record as advocating a non-surgical method for such a case but he believes that it can be so handled successfully with rigid and proper technique.

In the third group of cases no method can accomplish very much though radiation is preferable.

Superficial Malignancies. Charles F. Bowen, M. D., *Am. J. Roentgenol.* 9:255, April, 1922.

YEARS of experience have led the author to conclude that roentgen rays, radium and electric coagulation in proper combination will cure any cancer within reach.

Dr. Bovee's theory of "sickening" the cancer cells before applying heat led Dr. Bowen to employ a massive dosage of roentgen ray to the growth and surrounding tissue followed by

electric coagulation of the superfluous tissue. As an added measure he applies radium to the open ulcer. All three methods are used at one sitting.

The large majority of patients so treated present healing within one month of treatment though some have to receive a second roentgen ray treatment to accomplish this.

Radiological Ethics. Editorial, Jour. Michigan M. Soc. 21:269, June, 1922.

THE Wayne County Medical Society, Michigan, thus answers the queries of a Detroit roentgenologist regarding the ethics of his profession:

"Marked freedom with broad discretionary powers on the part of all x-ray men in imparting information is advised; first, because of the possibility of legal involvements; and second, because of the necessity of maintaining friendly relations with the men who refer their work to them. The Committee feels that courtesy should be mixed with firmness, and discretion and reserve with judicial freedom of action. * * *

"An x-ray man receives compensation, not for the act of making the picture, but largely for the opinion he renders, based on information derived from the pictures. Viewed in this light your opinion might be given to any reputable physician interested in the case, just the same as an opinion is given by the ordinary bedside consultant, having always in view, however, the necessary courtesy to the physician who first referred the case to you."

According to the Corporation Counsel of Detroit, hospitals have the legal right to retain all records, laboratory findings, x-ray plates and prints and they also have "the sole right in all such records, documents, and photographs, whether secured in connection with a private pay patient or a charity patient."

Generally speaking, the guide posts are the patient's interest and the golden rule.

A Conception of Chest X-ray Densities Based on a Study of Granite Dust Inhalation. D. C. Jarvis, M. D. Am. J. Roentgenol. 9:226, April, 1922.

THIS paper presents an interesting study carried out to determine the incidence of tuberculosis among granite cutters. Early in the investigation films were checked off showing densities suggestive of tuberculosis but the subjects appeared to be in excellent health, declared they were well, and were working every day. Physical examination yielded no constitutional or physical signs indicative of tuberculosis

and repeated and careful examination did not change these deductions.

"After this observation the only deduction which seemed warranted was that which led to the conclusion that granite dust inhaled charted the highway for all other irritants gaining access to the lungs by aspiration, whether they were mechanical, bacterial or chemical. It was realized that a pathological process was being observed, which was slight in its beginnings, generalized in its distribution and slow in its development."

The author's summary is as follows:

1. "Film densities are like the shifting sand of the sea, and because a density is present at the first examination seems to be no reason for expecting it to be present in a subsequent one.

2. "The evidence tends to show that film densities bring into prominence the lung and pleural lymphatics.

3. "The same densities are brought into view by various causal factors, apparently being no way in which the roentgenologist can determine, without the aid of the clinical history, the exact cause of the densities he is viewing.

4. "When other dusty trades are investigated the necessity for serial roentgenograms in studying a chest condition will be more appreciated.

5. "There seems to be a definite manner in which the densities progress from stage to stage in the development of chest film densities.

6. "It is a question whether the roentgenologist should report on the basis of stages with their pathological import rather than on the basis of the causal factor, which latter it would seem is the clinician's province to determine.

7. "The usual basis for diagnosing tuberculous activity is seen so many times on films of granite cutters as they leave and reenter the trade, that it hardly seems possible to consider the phenomena more than the indication of a lung working under stress.

8. "It would seem that the next step in tuberculosis is the economic one, when by means of wholesale x-ray examinations occupations will be determined which produce a suitable preparation of the soil for the development of a tuberculous process."

An interesting result of this study was the determination of the type of individual not apt to be injured by this work. After detailed study it was decided that an individual was a good risk in this industry in proportion to the absence of lymphoid tissue in the upper respiratory tract.

"One who works from an economic side is obliged to admit to himself that an early case from a medical point of view is a far-advanced case from the

economic standpoint, for many times it means the end of an industrial life. * * * Twice a year at least a worker in a dusty trade should have a roentgen examination of his chest in order that it may be determined whether he has reached the suitable soil, suitably prepared, stage."

Apical Pleuritis: A Statistical Study of Stereoscopic Roentgenograms. Jas. G. Van Zwaluwenberg and A. D. Wickett, Am. Rev. Tuberculosis, 6:106, April, 1922.

THIS is a study based upon stereoscopic roentgenograms of two hundred and sixty-seven, presumably normal, students' chests. These students were in the early twenties and were mostly Americans, coming from better than the average home, and at the end of their third or fourth year of residence at the University of Michigan.

The authors had frequently in their previous experience noted the occurrence of a roentgenological sign over the extreme apex of the lung, which was interpreted as an evidence of a pleural thickening. "Evidence has been adduced of its close association with tuberculosis of the parenchyma of the lung." It is believed to be the result of a tuberculous infection of the pleura in various stages of progression and retrogression. Some point about the mouth or pharynx, specifically the tonsil, is the port of entry of the infecting organism which reaches the lung by way of the pleura."

In the study two hundred and fifty-eight stereoscopic pairs were secured. Ninety-six showed the pleural line over one apex or both. There were sixteen observed cases of pulmonary shadows. Ten of these had both lesions present, which leads to the conclusion that one lesion predisposes to the other. The authors' conclusion is that these pleural shadows are a record of a past unsuccessful attempt at the invasion of the lung by the pleural route.

As a diagnostic and prognostic sign this shadow is valuable only as one learns to distinguish between the progressing and the arrested lesions.

The pleural line may be an indication of a progressive and serious invasion of the lung, but the fact that it was present in 37.2 per cent of apparently normal individuals makes it absurd to attach more than minimum importance to this shadow, and its significance must be judged in the light of other findings.

Careful employment of the x-ray is of great aid in the study of the etiology and pathological sequence of this disease but it is for the internist to decide whether a patient is simply tuberculous or has tuberculosis.

The Value of the X-ray in the Diagnosis of Tuberculosis. Charles Edward Hamilton, M.D., Long Island M. J. 16:202, May, 1922.

THE value of the x-ray in pulmonary tuberculosis consists in revealing an abnormal condition in the lungs, though it is impossible usually to properly interpret these findings without recourse to other clinical methods. Its chief use is confirmatory and in showing the exact extent, location, and character of the lesion. It has a definite value also in ruling out or proving tuberculosis in cases with doubtful physical signs though there are cases found without definite physical signs and with negative x-ray findings yet positive sputum. There may also be cases with physical signs which give a negative plate. Therefore clinical data must for the present remain more or less the deciding factor in tuberculosis.

Primary Carcinoma of the Lung. Robert I. Rizer, M. D., and Harold C. Habein, M. D., Minnesota Med. 5:352, 1922.

X-RAY diagnosis of carcinoma of the lung is thus disposed of in this article: "The x-ray in our experience has not been of material aid in the diagnosis of primary carcinoma of the lungs. There is no characteristic appearance as seen in the x-ray plate. The most frequent finding is a gross peribronchial thickening with nodulations seen usually in the lower or middle lobes. If seen early the condition is most likely to be interpreted as an unresolved pneumonia, bronchiectasis, or chronic pulmonary abscess. Later plates, however, showing the rapid extension of the mass, with or without involvement of the pleura, will either give the diagnosis or confirm the previous clinical diagnosis of carcinoma. The greatest aid which the x-ray can give is in ruling against metastatic tumor or tuberculosis. Both conditions are easily differentiated by x-ray from primary carcinoma, except where the pleura is involved."

The X-ray Examination. H. M. Toivell, M. B., Canad. M. A. Jour. 12:408, June, 1922.

THE x-ray diagnosis of pulmonary tuberculosis depends upon the definite changes wrought by the invasion of lung substance by tubercle bacilli. The reaction from this causes a round cell invasion at the site of the lesion which in turn is followed, in favorable cases, by the formation of fibrous tissue and calcification; in unfavorable cases it is followed by consolidation, cavitation, etc.

The x-ray will show slight flocculent shadows from cellular changes, dense shadows from consolidation, and increased translucency where lung substance has been destroyed. The changes wrought by round cell invasion and those wrought by early fibrosis are very difficult to distinguish and render it impossible to distinguish between activity and healing. Later fibrosis is not difficult to distinguish.

Three radiographic types of pulmonary tuberculosis can at present be distinguished, namely, hilum tuberculosis, peribronchial infiltration, and parenchymatous infiltration. In the first of these types the changes are principally around the hilum and show an increased shadow, more or less woolly. In the second type fanshaped peribronchial markings extend from the peripheral portion to the hilum and are studded by whitish nodules. Hila shadow changes are present. In parychmyatous infiltration small whitish, more or less discrete, shadows are characteristic and are found in small or wide areas in the upper chest in the region of the bronchioles. Pre-bronchial markings connect these shadows with the hilum.

Evidence may be present of all three types with one predominant. Knowledge of the pathology of the disease is absolutely requisite for reliable diagnosis, which, with this knowledge and with experience, may be fairly certain.

With respect to cavities these will be more or less annular with lung destruction surrounded by a zone of infiltration which shows a shadow inclosing a space in which lung markings are absent thereby distinguishing it from localized pneumothoraces in which these markings are at first apparent but disappear after a period of time.

Fibrosis may result from the tubercle bacillus or from other microorganisms and the differentiation is difficult, making history and physical findings essential to diagnosis. Pneumoconiosis and gas inhalation produce conditions resembling that produced by the tubercle bacillus.

An x-ray examination should be performed by stereoscopic plates and the screen, but the latter should never be used alone, nor should single plates ever be used.

Only those whose knowledge of the pathology of tuberculosis is coupled with experience in roentgenological diagnosis are competent to pass judgment upon these findings. It must also be borne in mind that the roentgenological diagnosis complements and does not supplant other means of diagnosis and there can therefore be no discussion of relative values.

Empyema. Philip P. Thompson, M. D., J. Maine M. A. 12:275, May, 1922.

IN a discussion of the etiology, pathogenesis and history of empyema of the chest the following discussion upon the importance of an x-ray examination occurs:

"Now knowing our physiology, and before having aspirated to corroborate our diagnosis and determine our bacteriology, it is most advisable, if possible, to take an x-ray. An x-ray examination is of great value and should be done before exploratory aspiration, if feasible, because in aspirating occasionally air is admitted into the chest and confuses the picture.

"Some may ask, 'Why is a roentgen examination of assistance?' Experience has shown:

"1. At times, when physical signs suggest fluid, and even the needle shows pus, the x-ray may show only a pneumonia or a pneumonia and a lung abscess.

"2. It may show several encapsulated collections of pus which require special treatment.

"3. It may show the presence of air as well as fluid, in which case bronchial fistula must be present, which would influence our treatment to be of more guarded prognosis.

"The x-ray should be taken with the patient in the upright position.

"In following the case after operation, the x-ray is of especial value in definitely following the expansion of the lung or the factors causing delay."

Treatment of Diphtheria Carriers by Means of the Roentgen Ray. Preston M. Hickey, M.D., Am. J. Roentgenol. 9:319, May, 1922.

THE writer states that "bacteriological examinations show that the percentage of cures in a selected number of throat cases is greater by the roentgen-ray treatment than by the local antiseptic treatment. The roentgen-ray treatment of diphtheria carriers is more easily carried out than a local treatment of the throat requiring swabbing of the pharynx, and is very much less dreaded than the operative procedure of tonsillectomy."

Since the above paper was written unofficial reports have been received which claim that the use of the roentgen rays have resulted in the disappearance of the bacilli from the pharynx within a few days after treatment. An official report will be made with regard to these cases as soon as the data can be collected.

Present Status and Surgical Treatment of Mouth Pathology. Bertram B.

Macht, D.D.S. Long Island M. J. 16:207, May, 1922.

ROENTGENOGRAPHY is one of the topics which the writer includes in his treatment of this theme and he greatly deprecates the ostracism extended by dentists and physicians to the commercial purveyors of x-ray pictures, since even with the best pictures and the most expert diagnosis only forty per cent of existing mouth pathology may be revealed. This loose and disconnected procedure "leads to failure and stigmatizes a practice, which when consistently and exhaustively carried out, is commonly attended by brilliant results."

The Close Relationship of the Erythro-genetic and Leukogenetic Functions of the Bone Marrow in Disease. Report of a Case of Erythremia. The Roentgen-Ray Treatment of Erythremia. Eugene P. Pendergrass, M. D., and Henry K. Pancost, M. D., *Am. J. M. Sc.* 163: 797, June, 1922.

BLOOD pictures of a few cases, reported in the literature show manifestations of both erythremia and myelogenous leukemia. These cases have polycythemia, cyanosis and enlarged spleen, and in addition have a definite percentage of myelocytes in the blood.

If there is such a thing as a combination of erythemia and myelogenous leukemia, or a midgroup between these, then the authors believe that the case here reported would come under such a heading, although the disease was primarily erythemia and later under some unknown stimulus the abnormal number of myelocytes appeared. Roentgen ray treatment was instituted and after various fluctuations the blood again became normal following the seventh series of treatments. The patient feels very well though the size of the spleen is larger than at first, and this in spite of occasional cross-fire radiation treatments. The writers report in a foot note, however, that a recent blood count showed the patient to have an anemia in which the red cells number 3,000,000 and the white count is normal, hemoglobin sixty-five per cent.

In leukemia the authors advise inhibitive doses over the long bones to inhibit the formation of red cells and destructive doses over the spleen. In erythremia they advise inhibitive doses over long bones and stimulating doses over the spleen, though as yet the basis of this phase of treatment is theoretical. A complete blood count should be made once a week.

Experimental data show that the spleen is more sensitive to roentgen rays than is bone marrow and that after

moderate doses the leukocytes show an initial rise followed by a pronounced fall with subsequent rise to normal. The red cells show an initial fall which may last for a long period or rise to normal within a few days. The following conclusions have been reached, though final judgment as to the success of radiation treatment is withheld for the present.

CONCLUSIONS

1. "Erythremia is a disease of the erythroblastic tissues of the bone marrow.
2. "Roentgen rays destroy or inhibit the formation of red cells.
3. "Roentgen rays should be used in the treatment of erythremia.
4. "Roentgen rays should be used in the treatment of secondary polycythemia when such cases fail to respond to other treatment such as drugs, venesection, etc.
5. "Roentgen ray treatment has been efficacious in the case reported above, and it has proved of value in such cases reported by other roentgenologists.
6. "Roentgen therapy affects a more permanent result than any other therapeutic measure used or recommended up to the present time."

Barium Meal Study in Gall-Bladder Diagnosis. Lincoln Kallen, M. D., *Northwest Med.* 21:172, June, 1922.

THE writer believes that instead of emphasizing the importance of searching for stones in gall-bladder disease that a careful analysis of the indirect evidence of gall-bladder disease readily and consistently demonstrated by barium meal study should receive greater attention. His summary is quoted in the following paragraphs:

"Twenty-one signs of chronic cholecystitis encountered in barium meal study are reviewed. This is probably not a complete list but comprises the most accurate signs met with in present day methods.

"The secondary manifestations of chronic gall-bladder disease are noted and their tendency to be responsible for symptomatology emphasized. The desirability of thorough search for primary focal infection is noted.

"The argument is presented to justify the more routine use of barium meal study, and a just appreciation by the clinician of the roentgenologist's position in gall-bladder diagnosis is sought."

Fluoroscropy in Diseases of the Abdominal Organs. Arthur Lawrence Holland, M. D., *New York M. J.* 115:659, June 7, 1922.

ALL physicians may not agree as to the relative value of x-ray plates, and their opinions vary probably according to their experience with good or bad plates and indifferent reports. This paper deals with the subject from the viewpoint of the internist.

Both plates and fluoroscropy have limitations and the ideal method includes the use of both. Protection must be kept in mind and "exposure to a ray the elements of which are a five inch gap to five mil., should not exceed twenty minutes within a period of two weeks as the effect is cumulative." The operator should wear lead impregnated gloves of the heaviest kind, as more than fifty per cent of the worth while evidence must be brought out by manipulation. Ten minutes should be allowed in the dark room for eye adjustment before examination is attempted.

The patient should not eat breakfast the morning of the examination nor should any cathartic be taken. At least one-half pound of barium is necessary for the meal. The patient, stripped below the waist, stands first in the anteroposterior position for examination of the heart, arch and lungs, then in the right anterior three-fourths oblique position and drinks the barium rapidly. Any defect or dilatation in the esophagus calls for a plate to be taken as an aid in differentiation of malignancy. The stomach must be examined from all angles and by deepest manipulation. The manipulation requisite for duodenal pathology is most difficult but proper technique is a question of patience in practice; nearly all such pathology can be diagnosed by the fluoroscope without plates. Only a little experience is needed to "type" a colon. If the appendix retains a fixed position or "kinks up" it is usually the seat of pathology but failure to visualize the appendix means nothing alarming.

The question of spasm is discussed. Other sources of trouble in the abdomen may be expressed "in this manner, so it is extremely dangerous dogmatically to ascribe this or that fluoroscopic syndrome to any particular lesion anywhere within or outside of the abdomen."

One hundred consecutive cases (postpyloric and duodenal ulcer, gastric ulcer, carcinoma, extra-gastric lesions) from the records of the writer's two surgical services at the New York Hospital when checked up gave ninety per cent correct diagnoses.

X-ray Evidence of Abdominal Small Intestinal States Embodying an Hypothesis of the Transmission of

Gastro-Intestinal Tension. R. Wal-
ter Mills, M.D., Am. J. Roent-
genol. 9:199, April, 1922.

WITH the exception of lesions of the duodenum the writer states that there has been no great effort at roentgenological investigation of small intestinal conditions, either normal or abnormal. The outlines which suggest gross obstruction are recognized but with the exception of gastro-jejunal ulcer there has been no conception that direct evidence of the involvement of the small intestine might be obtained.

For ten years past Dr. Mills has kept on file data secured in each x-ray examination made by him, systematically recording all findings not understood, and through this practice it became evident to him that certain small intestinal forms were associated with certain conditions that led to the idea of recoil with relative stasis, which he found to be supported by collateral evidence on every hand. Since 1916 atypical small intestinal outlines have been observed approximately six hundred times in making examinations of six thousand different patients. These findings grew more frequent as they were better appreciated. The accidental factor of the patients standing while a series of cases were plated made these findings apparent in the first place.

The subject is difficult to present in abstract form—because complicated and resting upon unrecognized principles. Each point is represented by an illustration or two and the exposition made with the aid of these. Appreciation of the evidence in the films is a matter of experience and education as one must become sensitized to changes in outline that at first are not apparent.

The following principles are stated and discussed and the evidence in support of them is submitted by the aid of sixty-two plates:

1. "When there is an organic alimentary obstruction there will be dilatation and motor delay proximal to it, their degree determined by that of the obstruction and the resulting proximal dilatation or hypertrophy.

2. "Evidence strongly suggests that the same far reaching proximal recoil occurs in somewhat less degree in functional stasis of the colon as in marked colonic constipation. The x-ray apparently shows that not only is there resulting motor delay throughout the entire colon but also secondarily in lesser degree in the small intestine.

3. "Any alimentary sphincter that is subjected to increased intravisceral tension originating either immediately proximal or distal to it tends to give

way, and if this tension is sufficiently great the sphincter becomes divulsed and incompetent, dilates in common with the contiguous dilated gut with resulting disturbance of proximal and distal motility.

4. "Any acquired lack of resilience in the gut wall, as from inflammatory or other pathological condition, will lead to recoil and relative proximal stasis.

5. "Rarely, but not to be mentioned as a possible principle, lesions lessening the recoil absorbing power of at least certain proximal portions of the alimentary tract determine a greater motility distant to it.

6. "It has been assumed that tension within the alimentary tube if not a constant throughout, still may be proximally influenced by changes in distal tension.

7. "Whenever there is over-rapid small intestinal motility from any source, the small intestinal forms will reflect this indicating over-distension and increased fluidity of the intestinal contents, more noticeable in the jejunum."

In the discussion following this paper high tribute was paid to Dr. Mills. Dr. Van Zwaluwenburg in the course of his discussion had said that after six years of study upon the subject he believed the greatest field in the future was in the small intestine and that roentgenologists are not pursuing this phase of their work as its importance warrants.

Clinical Lecture: Carcinoma of the Rectum, A. T. Bazin, M.D., Canad. M. A. J., May, 1922, p. 281.

1. "Carcinoma of the rectum is not uncommon in individuals of a comparatively early age.

2. "Abdominal cases must not be permitted to pass unexplained.

3. "Rectal bleeding and painful defecation demand such examination as will satisfactorily explain the cause.

4. "In carcinoma of the rectum the scirrhus type has a more unfavorable prognosis than the soft adenomatous type."

The Importance of Roentgen Ray Localization of the Intestinal Tube. Jacob Buckstein, M.D., New York M. J. 115:690, June 7, 1922.

1. "Various methods recommended for determining the location of the intestinal tube beyond the stomach are, with the exception of the x-ray, at best, highly suggestive and may be misleading.

2. "Even the aspiration of the duodenal fluid, while acceptable as a rule, may occasionally prove unreliable.

3. "The x-ray is essential for accurate determination of the exact area from which intestinal fluid for study has been obtained, and also for the exact point of entry of medication and of food.

4. "The x-ray will often help to determine the cause of obstruction in the curve of the tube."

A Practical Method of Roentgen Examination of the Heart Based Upon a Study of One Hundred Consecutive Normal and Abnormal Cases. Rolla C. Karshner, M.D., and Robert Helm Kennicott, M.D., Am. J. Roentgenol. 9:305, May, 1922.

ONE hundred two hearts were examined radiographically by all the accepted methods with the following conclusions: (a) The roentgenoscopic examination of the heart is far superior to the use of the seven foot plate. (b) A thorough roentgen-ray study of the heart embraces consideration of four elements; the shape of the cardiac shadow, its size, its motion, and the aorta. (c) The heart form is best studied by the roentgenoscope, the patient being examined in the direct and the oblique positions. Changes in shape in pathological hearts are due to relative enlargement of certain chambers of the heart as compared with other chambers, and such localized enlargement is best estimated by the A-V ratio of Van Zwaluwenburg and the use of the oblique positions of Vaquez and Bordet. The roentgenoscopic examination of valvular disease adds a quantitative estimation to the qualitative findings of the stethoscope. (d) The so-called cardio-thoracic ratio is a grossly inaccurate index to the actual size of the heart. (e) There are two practicable methods of accurately estimating the cardiac size from the orthodiagram: First, the use of the planimeter; second, the simpler method of Van Zwaluwenburg, which consists of the product of the long and short diameters of the silhouette compared with the normal, based upon body weight. (f) Expression of the cardiac area as a percentage of the normal is more satisfactory to the clinician than the statement of the actual area. (g) Much information may be gained from the study of the cardiac motion by the experienced observer. One notes the force, the tone, the organization, the co-ordination, the presence of excessive or insufficient motion, the intrinsic motion of various chambers, and the transmitted motion of the heart as a whole, together with its relationship to other structures in the chest. (h) The aorta, which is normally an inconspic-

uous portion of the cardiac shadow, takes on definite characteristics in certain cardiac pathology. Chiefly among these are the changes due to age, hypertension, arteriosclerosis, lues, and pathology in the aortic valve."

Roentgen Rays and Radium in the Diagnosis and Treatment of Carcinoma of the Prostate. H. C. Bumpus, M. D., *Am. J. Roentgenol.* 9: 269, May, 1922.

SUMMARY

1. "The average duration of cancer of the prostate, if untreated, is approximately three years.

2. "Roentgenograms show that metastasis to the bone occurs in about one-third of the cases of cancer of the prostate.

3. "Metastasis from atypical carcinoma of the prostate, in which the cells, because of their tendency to early metastasis, produce only slight local enlargement, may be frequently mistaken for Paget's disease.

4. "The clinical study of these cases demonstrates that in order to treat successfully cancer of the prostate with radium it is necessary to use in the aggregate large doses (3,000 to 4,000 mg. hours), exposing all parts of the gland to comparatively small doses.

5. "It is demonstrated that the increased duration of life following radium treatment in cases of cancer of the prostate is in direct proportion to the amount of radium radiation applied.

6. "No one method of application radiates all portions of the gland.

7. "The malignant gland must be radiated by urethral and rectal exposures, and by needles inserted directly into the neoplasm in order to produce complete radiation of all portions.

8. "It is demonstrated microscopically, that large doses of radium placed directly into the gland affect only a limited area; this is substantiated by the clinical findings which prove that the course of the disease after such treatments is but slightly affected.

9. "In the parts of the gland affected by the radium, fibrous tissue is produced which enmeshes and compresses the cancer cells, preventing their further proliferation. If this process could be brought about in the entire growth, complete cessation of the disease would result.

10. "Sacral anesthesia is a useful adjunct in the application of radium needles, making it possible to place the radium accurately and to change the position of the needles without pain;

thus a more thorough radiation of the gland is accomplished."

Pneumoperitoneum in Kidney Diagnosis With Special Reference to the Detection of Retroperitoneal Masses. L. R. Sante, M. D. *J. Urology*, 7:451, June, 1922.

PNEUMOPERITONEUM is not only useful from the standpoint of diagnosis, but often gives the surgeon information as to conditions which will be encountered upon operation.

Occasionally the method is useful in detecting the presence or the absence of a kidney, or in detecting abnormal mobility.

Enlargement of the kidney requires careful analysis of the shadows as this condition may be due to one of various causes, perhaps to fat, carcinomatous metastasis, or to the kidney itself.

For the examination of the outline of the kidney the lateral position is used but if an abdominal mass is found present the retroperitoneal position is necessary to determine origin and relationship to thickening.

The radiographic characteristics of various retroperitoneal masses are described, for example new growths, perinephritic abscesses, tumor masses, psoas abscesses and carcinoma; these are also described for pyelitis, pyelonephritis and tuberculosis of the kidney.

Pneumoperitoneum is of advantage also in demonstrating certain lesions of the urinary tract, and when properly used the author considers it is no more dangerous than ureteral catheterization with injection of opaque material.

The method is not a short cut to diagnosis of all intra-abdominal lesions and should be used only with rational consideration after all other routine methods have failed and it must be interpreted in conjunction with other clinical findings.

Pneumoperitoneum as an Aid in the Diagnosis of Cardiospasm. Samuel Iglauer, M. D., *New York M. J.* 115:745, June 21, 1922.

THIS paper reports the successful use of pneumoperitoneum in a case of obscure cardiospasm and the writer believes that the method should prove of considerable value in other obscure cases, and states that it is practically free from danger.

Tumors of the Urinary Bladder. Milton Weinberg, M. D., *J. S. Carolina M. A.* 18:137, May, 1922.

THE high frequency current used through the catheterization cystoscope for the treatment of bladder tumors is ideal for all benign and many malignant papillomata but not success-

ful in malignant papillomata and never for papillary carcinoma or any other type of tumor that has invaded the bladder wall. Failure to yield to this treatment is conclusive evidence of malignancy.

The status of radium in the treatment of bladder tumors is not fully established. Geraghty has found it useful in some cases. Judd thinks its chief value is in inoperable cases.

Modern Methods of Urological Diagnosis. N. P. Rathbun, M. D., *Long Island M. J.* 16:173, May, 1922.

THE writer in his practice aims at diagnosis in one sitting. This grouping of the several examinations is a feature of urological diagnosis for which he claims originality.

In addition to the history and physical laboratory examinations he insists upon a pyelogram. This may not prove necessary always but it does no harm and often great good, for if made a routine procedure it often elucidates important data which otherwise would escape notice.

Importance of Roentgen Examination in the Early Diagnosis of Renal Calculus. William H. Schmidt, M. D., *New York M. J.* 115:533, May 3, 1922.

THAT a renal calculus should reach a large size with accompanying infection, and should be allowed to almost completely destroy the kidney before radiographic study has been even attempted, is almost inexcusable. Indefinite abdominal symptoms extended over a long period of time call for radiographic study together with careful consideration of the history of the case. The majority of these cases, if symptoms are due to renal calculi, can be diagnosed by aid of the x-ray and the kidney saved as a result. The responsibility of recommending the examination rests largely with the general practitioner.

X-rays in Obstetric Practice. Edward W. H. Shenton, M. R. C. S., *Lancet* 202:860, April, 1922.

THE writer states that useful information might be obtained from subtle evidence many times were it not for the fact that "surgeons of the present day ask for radiographic results which in their clarity would almost satisfy a common jury."

He goes on to relate that two conditions hamper radiographic findings in obstetric cases, namely, the quantity of fluid and the paucity of mineral matter in fetal bones. Perhaps by the fourth month, and certainly by the fifth or sixth, the rays may often be useful

in determining the presence of pregnancy or abdominal tumor, position, relations of head and pelvic canal, and the presence of twins.

He cites one case from his own practice where use of the x-ray obviated a contemplated induced premature labor because there was shown to be room and to spare in what was at first thought too small a pelvis.

These pictures will not often be clear but they will be sufficiently so to give the needed guidance and the x-ray exerts no harm at all upon the fetus.

As to technique he says: "I would suggest anteroposterior position for head and pelvis, the latter being tilted so as to give a comprehensive view of the pelvic canal. Stereoscopy is useful if practicable. For the abdomen the lateral position, the patient lying on her side (is the proper one). The plate must be large and comes well over the crest of the ilium. Intensifying screens and other aids to rapidity in the photographic process will be essential."

Radium Treatment of Myoma of the Uterus and Myopathic Bleeding. C. Jeff Miller, M. D., Surg. Gynec. Obst. 34:593, May, 1922.

ANY other than the present very satisfactory surgical method of treating myoma of the uterus "must present properties rarely possessed by a therapeutic agent, and the result obtained by such a remedial agent must show that the relief is permanent and that its use is safer than operation and gives a larger percentage of preservation of physiological function than an operation performed by a skillful surgeon."

The writer believes that radium is such an agent and for proof cites results secured in one hundred and eighty-three cases treated with radium and now observed over a period of more than seven years. As proof that he is not radical upon the subject of roentgen therapy he cites the fact that he has employed surgery in nearly an equal number of such cases during the same period, according as the factors of age, type, social situation, size of tumor, condition of the appendage, evidence of previous infection, and general condition of the patient demanded this form of treatment.

A review of these cases treated by radium "warrants the conclusion that a large percentage of the cases of myoma of the uterus, formerly subjected to radiation can be permanently and safely relieved by radium and that practically all cases of uncomplicated essential hemorrhage can be cured by radium."

The Treatment of Myoma Uteri and Menorrhagia with Radium and Roentgen Rays. S. A. Hyderdahl, M. D., Acta Radiologica 4:366, April, 1922.

DR. Hyderdahl in his summary of this paper reports that "of thirty patients suffering from myoma uteri twenty-five were exclusively treated with roentgen rays, and five were given combined roentgen and radium treatment."

"In twenty-five cases a good result was obtained; cessation of the menses, together with complete or partial disappearance of myoma in most cases. Five patients were operated after the roentgen treatment. Of thirteen patients suffering from menorrhagia twelve cases attained to a complete cessation of the menses. In one case there was a recurrence and later on an operation."

Continuous Uterine Hemorrhage of Three Years Duration in a Girl of Seventeen Years, Cured by One Application of Radium. D. Y. Keith, M. D., Kentucky M. J. 20:365, May, 1922.

THIS patient before receiving radium treatment had been subjected to curettage and to a ventral suspension to relieve a condition in which menstruation had been present continuously for more than a year. Improvement was only temporary. Internal glandular secretions administered produced some improvement for a time but this likewise did not prove to be permanent. Upon her admission to the hospital for radium treatment menstruation had again been daily continuous for more than fifteen months.

Under gas-oxygen anesthesia four needles containing fifty milligrams of radium, one millimeter brass screening, was introduced into the uterine cavity and allowed to remain for one hour and forty minutes. No curettage was performed. The menstrual flow ceased for two weeks whereupon normal menstrual flow made its appearance and since that time (April, 1921), menstrual periods have remained normal and the patient is in excellent general health.

The writer is not conclusive in his statement but gives a very decided impression of believing that this form of therapy, properly administered, may be used without fear of resultant sterility.

The Practical Status of Deep Therapy with the Advent of X-ray Intensities. Edwin C. Ernst, M. D., Southern M. J. 15:448, June, 1922.

RADICAL changes in the technique of radiation such as have lately

been made should be accompanied by equally radical changes in the physical and electrical methods of producing such radiation. The method of transforming electrical into radiation energy is and will continue to be a basic problem.

The writer describes the unscientific attempts made and the widely differing radiation reached by some roentgenologists in trying to duplicate the same technique and he exposes and makes plain the fallacies which underlay their reasoning. Much harm has been done by just such inaccurate procedures.

Comparative quantitative and qualitative measurements of the skin and depth doses are essential to proper treatment. The supposed effect of radiation upon normal and pathological tissues must be clearly understood. The radiation dose with reference to the amount the patient has received and his reaction, as well as the amount absorbed by the local tissues must be carefully considered and this depends upon: (1) the intensity of the radiation, (2) its quality, (3) the duration of the exposure, (4) the area exposed, and (5) the kind of tissues receiving such radiation.

The following are the physical factors in every treatment, given from the standpoint of the unfiltered x-ray dose: (1) The voltage applied to the tube and the means used for exciting such a tube. (2) The type of the tube. (3) The current through such a tube. (4) The focal skin distance. (5) Duration of the exposure. (6) Size of area exposed.

The problems of increased focal distance, copper in place of aluminum, size of areas, and reaction of the patient are considered at length.

As to foreign technique he states that it is extremely difficult accurately to compare voltage equivalents between transformers abroad and those employed in America, but there is profit to be derived from the German studies of the ionization method of measurements, relationship of the superficial skin dose to the necessary depth dose, the individual values of various sized filters, most practical focal skin distances with given filters, etc., etc. If any of these physical factors are to be modified the work must be checked on a physical basis, else underraying and overraying may result.

In reply to the question as to whether the present more intensive deep therapy is producing better results he replies that it is. He states that in his belief earnest co-operation of physicist, biologist and radiologist may usher in an era productive of permanent results in malignancy.

He closes with the reiteration of what has been previously stressed, namely, that the radiologist's future rests upon the added precision with which effective electrical instruments and physical methods are selected—and upon the knowledge, training, and skill of the man using them.

THE Modern Hospital, 18:311, April, 1922, contains a short article upon the administration of radium in which Dr. Bowing of the Mayo Clinic is quoted as saying that much of the misunderstanding with regard to radiotherapy is due to negligence as well as to inexperience and incompetence upon the part of those responsible for treatment. He states that it would be almost as absurd to expect good results from surgery simply because of a fine equipment as it is to expect the same sort of results from radiotherapy simply because the equipment is of the best.

In hospitals some one physician should have absolute charge of radiotherapeutics and he should frequently visit other large radium clinics. Consultation with the other members of the staff before therapy is decided upon should be the rule.

Critique of Modern Roentgen Therapy in Cancer. M. I. Sittenfeld, M.D., Med. Rec. 101:660, April 22, 1922.

THE writer is enthusiastic in his support of pre-operative radiation in carcinoma, especially that of the breast. This treatment he believes should precede operation by about two weeks, after which postoperative treatment should be given.

The importance of filtration, proper distance, portal of entry and other points of technique are emphasized.

The entire dose with maximum intensity should be given at one time whenever this is at all possible; this is much more preferable than several smaller doses at intervals.

There is need of greater co-operation between surgeon and roentgenologist.

The danger and the prejudice arising from unskillful use of the x-ray is vigorously commented upon.

In Modern radiotherapy, the writer believes, is only beginning.

European Impressions and Personal Experience in the Use of High Voltage X-rays in Deep Seated Malignancy. Robert H. Millwee, M.D., Southern M. J. 15:444, June, 1922.

MILLWEE'S technique for malignancy of the pelvis is: Voltage

230,000 peak volts measured with sphere gap. Filter $\frac{1}{2}$ mm. Cu. and 1 mm. Al., 10 mm. sole leather. Skin-target distance, 24 inches. Ma. 4. The ionization method is used for measuring dosage. Four fields, none smaller than five inches, are used and two hours of eight ma. hours gives a good erythema as a rule. Eighteen hundred mg. hours of radium are used treating the cervix and uterus. For heavy patients a thirty-inch skin target is used and for breast cancer forty-inch skin target but only one large field. These principles apply to all cases of malignancy situated below the surface of the skin.

One hundred and eighteen inoperable cases have been treated by this technique and ninety per cent of them show marked improvement; so far no deaths have occurred.

The author regards as reasonable the theory that malignant cells develop a tolerance for roentgen and radium rays and he believes, therefore, that a massive dose at one sitting should be given to all patients in good physical condition. Such patients should have a blood count of over 4,000,000 reds and hemoglobin seventy per cent. Two and one-half million reds and half the whites may disappear as a result of the treatment but the blood returns to normal in from one to two days.

Toxemia has not been so marked as has been observed in German clinics and he believes this is due to the elimination of all gases, noise, and nerve racking elements from the treatment room. In pelvic cases, bladder irritation and diarrhea is sometimes consequent upon treatment.

The writer does not recommend his technique as perfect, in fact he is inclined to work out some further changes in it but he feels much encouraged by the results secured.

The following is his summary of observations made by him in German clinics:

(1) "Voltage of 220,000 peak volts was used. Radium was usually used in connection with x-rays. (2) All believed that the action of the rays on cancer cells was a direct one. (3) That the advantage gained by the employment of x-rays of high voltage (220,000) is that of better dosage to deep seated lesions without permanent damage to essential normal structures. (4) They were unanimous in their approval of the accurate measurement of dosage by the ionization process, and all workers used the method in some form. (5) Heavy filters of from $\frac{1}{2}$ to 1 mm. of copper or its equivalent were used in all clinics. (6) The determination of proper dosage for va-

rious types of tissue was considered seriously by all, and the various workers differed but little on this point.

"It was generally admitted that in some cases the proper dose of ray for the destruction of carcinoma cells does not depend upon the histological picture of malignancy as upon the general condition of the patient. The various workers visited were enthusiastic as to results obtained."

The Present Status of Deep Roentgen Therapy in Europe. W. H. Stewart, M.D., Am. J. Roentgenol. 9:315, May, 1922.

THE team work in German clinics where eminent physicists work hand in hand with clinicians greatly impressed the writer upon his visit abroad. He believes that this co-operation accounts in large measure for the great advancement made there of late.

Great differences of technique were noted, but the administration of a death-dealing cancer dose was the same in all large hospitals visited. All are working on the problems of exact measurement of the x-ray dose, deep introduction into the tissues of the hard filtered x-rays, and the determination of the correct x-ray dose.

The problem of exact measurement of the depth dose, the Germans generally believe, has been solved by the iontoquantimeter which has now been in use two years. The writer gives interesting descriptions of several means of measuring the depth dose in vogue among German workers. He believes that these instruments may be reliable in the hands of a responsible physicist, but that it is not yet safe to state that one can rely upon them entirely.

He states that it is difficult, during a short visit, to exactly ascertain the clinical results and that as a rule he found conservatism upon the subject of ultimate cure.

AN editorial in the Journal of Electrotherapeutics and Radiology, May, 1922, discusses Holzknecht's changed views in regard to the use of massive dosage. He is quoted as saying that the single maximum dose is wise in treating malignancies, but that the medium or fractional dose is the one to be used at all other times. He is also quoted to say that harm has come as the result of the massive dose method.

The editorial goes on to say that "It is difficult to understand how any physician who is familiar with the effects dare use the terrific doses that are being advocated by German physicians, except in the early stages when the tumor or growth is too small to produce dangerous toxic absorption when broken up."

What Every Doctor Should Know About Cancer. Joseph Colt Bloodgood, M. D., Texas S. J. M., 18:77, June, 1922.

DR. BLOODGOOD in addressing a general session of the State Medical Association of Texas laid the responsibility of educating the community in the knowledge of cancer directly upon the general physician, and indirectly laid the responsibility of educating the general physician upon the specialist by his statement that physicians referring cases to himself no longer delay to take this action in any case that shows signs of incipient cancer.

In this paper he discusses the topic of publicity and the question of whether doctors delay in cases of cancer; the warnings of cancer and the fact that they do not differ from those in cases that are not cancer; examination and its importance; the medical adviser; the message in regard to cancer; prevention; what publicity has accomplished; the added responsibility laid upon the medical profession as a result of this education, and the fact that there is no second treatment for cancer, that is, it must be eliminated at the beginning of treatment.

Under this last topic he says: "The selection of surgery, with knife or cautery, radium or x-ray, one or the other, or their combination is essential, because in the early stage of cancer cures should be accomplished in a large percentage of cases if the proper method is applied at the proper time."

In answer to a possible charge by the layman that cancer propaganda is a commercial enterprise, he says that "it is commercial only in the sense of the highest height of commercialism; that its advertisement is true and what is promised will be delivered."

The Medical Side of the Cancer Problem. A. C. Scott, M. D., Texas S. J. M., 18:81, June, 1922.

THE text of this paper, read before the same body as the preceding paper, by Dr. Bloodgood, is: "People should know about cancer before they have it. 'The enormity of the task of educating over 100,000,000 people can scarcely be conceived, especially as pertains to a subject about which most of them have notions only a few steps removed from heathenism.' If every one of the 85,000 members of the A. M. A. did his part there would be eleven hundred people to each physician, but the lamentable fact is that the general physician, as a rule, knows little about the predisposing causes of cancer or its early diagnosis and has only an occasional or a very casual interest in the matter. This inexcusable state of affairs is severely censored and

the truth of the writer's charges is supported by his discussion.

Endothermy. George A. Wyeth, M. D., New York M. J., 115:437, April 19, 1922.

CANCER specialists recognize the fact that no one method can be unreservedly adopted, and the value of radium, x-ray and endothermy is appreciated by the up-to-date surgeon.

The advantages of this last form of treatment the writer considers are the following: (1) decreased danger of metastasis and likelihood of recurrence, (2) alleviation of pain, (3) practically no hemorrhage, (4) practically no surgical shock, (5) accurate dosage, (6) incidental sterilization of the wound, (7) satisfactory postoperative condition leads to quick recovery, (8) good cosmetic result.

Some striking results are recounted in cases of facial malignancy, a number of which are described and illustrated.

The Cancer Problem. Herbert A. Bruce, M. D., F. R. C. S., Canad. M. A. J., April, 1922, p. 225.

THE writer believes in excision followed by x-ray or radium.

There is little excuse for fatal termination of cancer originating at the surface of the body.

In judging the effects of therapeutic methods in malignancy the size of the tumor is the sole criterion; relief of pain, circulatory changes in the tumor, and restoration of secondarily impaired function is of little value, even the size of the tumor may be misleading.

The writer sees no advantage from pre-operative x-ray treatment, but advocates postoperative treatment. He disputes the value of radiotherapy for superficial cancer, advocating operation for this whenever possible.

In deep cancer he advocates the x-ray for palliation and as a postoperative measure. "Radium seems to have a special place in carcinoma of the cervix uteri."

Observations on the Use of the Copper Filter in the Roentgen Treatment of Deep Seated Malignancies; Thos. A. Groover, M. D., Arthur C. Christis, M. D., Edwin A. Merritt, M. D., Southern M. J., 15:440, June, 1922.

THE necessity of being able to deliver as effective a "knock-out" blow to deep seated lesions as is now possible to deliver to superficial ones is apparent from the fact that no great diminution of mortality from deep seated lesions has been accomplished by the technique of the parallel spark length of eight to nine inches, filtration with two to six millimeters of aluminum, and crossfiring through a various number of portals.

The writer, therefore, attempted to approximate the German technique as he understood it, and as a result of this effort adopted the following technique, used with slight modifications according to the case:

Spark gap measured between blunt points $8\frac{1}{2}$ to $9\frac{1}{2}$ inches. *Milliamperes* 5. *Filtration* 0.5 mm. Cu under which is placed 1 mm. Al. *Skin-focus* 12 inches. *Time of exposure* 3 hours.

One to four areas have been treated with exposure time varying from three to twelve hours with not more than two hours daily treatment, and as a rule not more than one hour daily or on alternate days.

Roentgen sickness is as severe as with former methods. The effect on the skin varies from bronzing and desquamation to vesication, but healing has been complete within four weeks at the most. Difficulty in swallowing and huskiness result from treatment about the neck and upper thorax, but these subside. Pulmonary pneumonia has also resulted in some cases. Diarrhoea has sometimes occurred in uterine cases and in one case of cancer of the cecum uremia developed.

It is too early as yet to claim permanent cures. The technique above described has been used with seventy-five cases, all but eight of which were hopeless. Some of these have died and many of the others must inevitably die of cancer, but in many of the cases a complete disappearance of the local evidence has occurred, or is rapidly occurring, and the present status of these cases is very encouraging.

With regard to cancer of the breast the writers advise deferring operation for approximately two months and administering a single series of roentgen treatments with a "not less intensive" technique than the one described here. The advantages, they believe, are:

(1) The actual volume of cancer tissue would be greatly lessened and would in some cases disappear entirely, so far as could be determined by physical examination. (2) The danger of cancer dissemination incident to surgical trauma would be lessened. (3) A number of borderline cases would become definitely operable.

In the discussion following the reading of this paper Dr. Groover stated that he did not lay claim to having "the best" technique, as no one at the present knows what is the best.

The Possibilities of Irradiation in Malignant Disease. L. J. Cleudinnen, M. B., M. J. Australia, April, 1922, p. 456.

THIS is a paper written for the information of the general practitioner, and takes up the subject of x-ray briefly in its various phases, from the

physics of x-ray to the latest technique. The author summarizes by saying that technique and equipment are passing through a rapid and important development and that the time is not yet ripe for radiation to supplant surgery, but that the success of radiation is assured and that the future has great possibilities, dependent to a large extent upon the friendly and intelligent co-operation of surgeon and radiologist.

Heliotherapy in Treatment of Laryngeal Tuberculosis. William C. Voorsanger, M. D., *Am. Rev. Tuberculosis*, 6:223, May, 1922.

Verba's apparatus, used in heliotherapy of laryngitis and laryngeal tuberculosis, reflects a higher percentage of ultra violet rays, absorbs many heat rays, and does away with the objections formerly arising from the hyperemia induced.

The patient is taught to manipulate the apparatus himself. The writer uses this form of therapy for all cases; even those far advanced are made comfortable by it. Of seven cases treated by the author, two are regarded as cured, three are still under observation and are improving, and two left the sanatorium improved, but before a definite result could be obtained. Complete arrest is possible in infiltration and mild ulcerative stages if the treatment is carried out for six months.

Actino Therapy in Infection. Arthur

E. Schiller, M. D., *J. Michigan M. Soc.*, 21:247, June, 1922.

The writer has used the ultra violet rays in the treatment of abscesses, bone tuberculosis, tubercular glands, bone and joint infections, chronic leg ulcers, infected incision wounds following operations, infected injury wounds, indolent ulcers such as x-ray burns and chancroidal ulcers. If employed early enough they "will abort infection and prevent abscess formation." In the later stages they hasten suppuration, relieve pain and hasten repair. He summarizes thus:

"(1) Ultra violet light is an agent that should not be neglected in the treatment of infections. (2) It will stimulate the normal defensive power of the blood, sterilize tissues, produce active hyperemia, inhibit bacterial action and regenerate epithelium. (3) It is not a panacea, but must be used in conjunction with other surgical measures. (4) It will give quicker relief from pain and freedom from infection than any other agent. (5) It is fool proof and can be used on all parts of the body without danger."

Quartz Light Therapy in Pelvic Inflammation. L. C. Donnelly, M. D., *J. Michigan M. Soc.*, 21:254, June, 1922.

ABOUT nine thousand treatments, a large number of which were given in gynecological cases, are here cited and are said to have produced marvelous results in some cases and benefit in all.

Mild pelvic inflammations can be cured without operation. General treatments are given with Alpine, sun, and radiant lamps, and local treatments with the Kromayer lamp. These latter often give relief immediately and they have a general tonic effect. The more acute the inflammatory condition the larger the dose and the less severe the reaction is the rule. Material benefit becomes increasingly apparent from week to week. Pre-operative treatment practically assures speedy healing.

It is regarded as proved that quartz light radiations produce additional leukocytes and hasten their maturity, thus building up the body's immunizing powers.

An Essay of the History of Electrotherapy and Diagnosis. Hector A. Colwell, M.B., L.R.C.P., M.R.C.S., D.P.H., Wm. Heinemann, 20 Bedford St., London, W. C. 2., England.

DR. COLWELL begins his essay with an account of the use of the torpedo, an elasmobranch fish of the ray family, as the first source of static electricity employed in the treatment of disease. He traces the history of medical electricity as it rises to the advantages accruing from royal and other distinguished patronage in the middle of the eighteenth century and then gradually declines on account of over exaggerated reports until 1831, when Faraday discovered electromagnetic induction, which ushered in a new era.

Some of the high lights touched upon are Holtz, in 1865, and his induction machine; Duchenne, 1840, the founder of modern electrotherapeutics; H. D. Ruhmkorff, 1803-1877; W. E. Steavenson, 1882-1890; Lewis Jones, 1890, 1911; and Sir Wm. Crookes, 1832-1919, whose work rendered possible the discovery of the x-rays in 1895 and the later work of living scientists.

The book closes with a short account of the discovery of radium and a tribute to Becquerel, Schmidt, M. and Mme. Curie and others.

Wide use is made of interesting illustrations. There are one hundred and fifteen in all. These are widely diversified, including as they do photographs of the great and near great, living and dead; different examples of apparatus; and also a copy of "The New Photographic Discovery" taken from a modern "Punch." This last suggests the lighter vein that is not lacking in

this truly accurate historical work, which shows a prodigious amount of careful research and detail work. The whole is written in a delightful and clear essay style and holds the reader's interest straight through its one hundred and ninety pages. It is attractive also in the very excellent quality of paper used and the easy reading print. It deals with the development of different forms of apparatus, perhaps somewhat, as the author says, to the exclusion of a connected view of the progress of electrotherapy itself. But this last is sketched in lightly in the concluding pages.

The dedication page reads simply, "Dedicated to Robert Knox, M. D." But that is enough to an English reader. For, as one ardent admirer of Dr. Knox said in speaking of some position of administration which Dr. Knox occupied, "Well, you know, Dr. Knox is back of everything."

Oral Roentgenology: A Roentgen Study of the Anatomy and Pathology of the Oral Cavity. By Kurt H. Thoma, D. M. D. Second Edition, Revised and Enlarged. Octavo 341 pp., 470 illustrations. Lea & Febiger, Philadelphia and New York, 1922. Cloth, \$6.00.

THIS second edition of Thoma's well known "Oral Roentgenology" (1917) has been considerably amplified, the additional subject matter covering one hundred and twenty-nine more pages than were in the first edition, exclusive of fifty-nine new photos, diagrams and plates.

The author states in the preface that the text has been almost entirely rewritten and that the new terms adopted by the American Academy of Peridontology have been used in the section dealing with peridental diseases. Additions and one entire new section have been added, the theme of the latter being roentgen technique. This section, written for the student and beginner covers fifty pages written in the simple style which medical writers too often shun to the great detriment of force and clarity. The short discussion of roentgen examination of the teeth in dental and trigeminal neuralgia are also new.

Additions and changes have been made in the sections on interpretation, abnormal dentition, diseases of the hard tissues of the teeth, those of the dental pulp, peridontoclasia, diseases of the maxillary and mandibular bones and those diseases of the accessory sinuses of the nose.

All roentgen pictures have been reproduced in the negative as in the first edition and are excellently done.

The author's name is sufficient guarantee of the excellence of the work.

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A Roentgenographic Study of Developmental Anomalies* of the Spine*

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IN routine examination made in the Section on Roentgenology of the Clinic, developmental anomalies of the upper spine have been a rare finding. Congenital defects in the segments of the lower lumbar spine, particularly the fifth, and of the sacrum have been observed so frequently that a tendency to discount their significance has developed. Only a careful review of a large series of cases studied from the clinical point of view served to stimulate sufficient interest to continue reporting them.

ANOMALIES OF THE SPINE

Meisenbach, in 1912, reported the absence of the cervical spine in a girl 10 years of age. Fitch, in 1909, quoted Wertheim as having reported a case of congenital absence of the entire sacrum and coccyx in a child, and reported one case of his own in which roentgenograms revealed entire absence of the vertebrae below the first sacral, which was rudimentary, and anomalies of development in the upper fourth dorsal and seventh cervical vertebrae. Norbury, in 1913, reported a case of deformity of the spine in which the first

and second lumbar vertebrae were wedge-shaped and the roentgenogram suggested an extra lumbar vertebra. In discussing this case Langmeed reported having seen a wedge-shaped extra bone between the last dorsal and the first lumbar vertebrae. Crookshank, in 1914, reported a case in which there was an absence of the lumbar vertebrae, an imperfect pelvis, and small immobile limbs. The spinal canal ended at the twelfth dorsal in a small bony boss, and there were no lumbar nerves. Decker, in 1915, reviewed the literature on numerical variations in the vertebrae and reported a case in which six lumbar vertebrae had been seen in a dissecting room specimen. He quoted Bardeen as having found, in a large series of specimens, 16 per cent of vertebral columns with numerical variations of the vertebrae. About an equal number of specimens showed increase or lack of increase in the number of segments in one section, when the other section showed an increase. Decker also called attention to the wide variety of morphologic variations seen in the spine, often in the lumbar region, and their common association with definite disturbances of body function. Kleinberg, in 1916, reported a case of congenital anterior curvature of the spine in

an infant four months old and directed attention to the fact that older writers looked on this as a primary congenital lesion. Hodgson, in 1916, quoted Putti as having said that congenital or developmental anomaly in a rib surely is associated with some anomaly in the vertebra, but that the converse is not true. He also reported that congenital elevation of one or both scapulae is sometimes found with anomalies of the vertebrae or ribs. Hodgson showed many plates of anomalies of the spine and ribs. Roth, in 1920, reported a case in which an extra half vertebra on the left side, between the eleventh and twelfth dorsal segments, carried a rib. Only one-half of the ninth dorsal was present and it was fused with the tenth. Scoliosis had resulted.

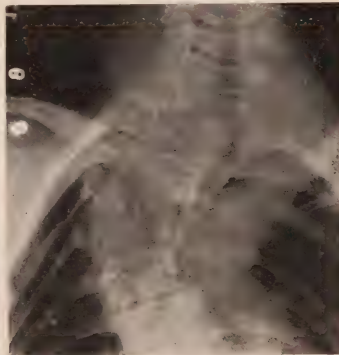
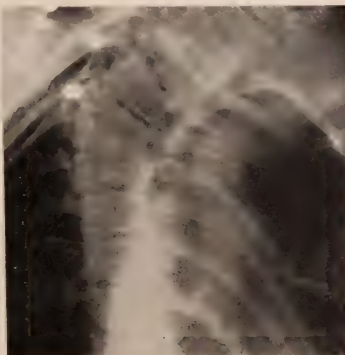
REPORT OF CASES

Case 1 (A210393). Anomaly of ribs and spine in a woman aged 27 years. (Fig. 1) The body of the seventh thoracic vertebra was wedged with the thin edge toward the left side. Two ribs articulated with the seventh vertebra on the right. The body of the eighth vertebra was normal in contour and two ribs articulated with it on the left. On the right the transverse process of the eighth rib was replaced by a bony bridge, which continued with it

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.



Fig. 1 (A210393). Anomaly of ribs and spine in a woman aged 27 years.



Figs. 2 and 3 (A204019). Anomaly of the ribs and spine in a girl aged 11 years.

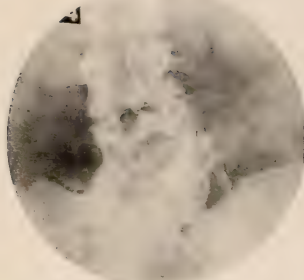
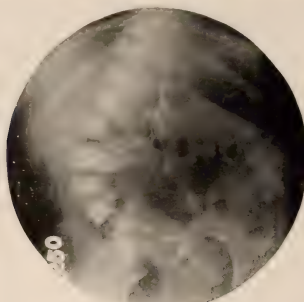


Fig. 4 (A299904).—Anomaly of the fifth lumbar vertebra in a woman aged 40 years.



Figs. 5 and 6 (A232250). Congenital deformity of the lumbar spine and sacrum in a boy aged 4 years.



and occupied the space normally taken by the ninth rib. The ninth rib was absent. The body of the ninth vertebra was wedge-shaped with the thin edge to the right. This patient came to the Clinic because of another complaint without symptoms traceable to the deformity, and the anomaly was discovered in the course of a routine examination.

Case 2 (A204019). Anomaly of the ribs and spine in a girl aged 11 years (Figs. 2 and 3). This patient had marked scoliosis of the upper thoracic vertebrae. The third and fourth ribs were fused just beyond their angles, and the body of the fourth thoracic was wedge-shaped with the thin edge toward the left side. The deformity had increased during the two years previous to examination.

Case 3 (A299904). Anomaly of the fifth lumbar vertebra in a woman aged 40 years (Fig. 4). The laminae of the fourth lumbar vertebra pointed upward with some irregularity in their juncture, while those of the fifth overlapped at the point of juncture; the left was above. The left ala of the sacrum was bisected by a groove, behind which a small process of bone ran to the ilium. The outer portion of the ala appeared to be fused with the

body of the fifth lumbar vertebra and descended vertically to join the ilium. The patient gave a history of having had dull, aching pain in the groins and hips for a number of years, but clinically this was ascribed to an abdominal condition for which operation had been performed.

Case 4 (A232250). Congenital deformity of the lumbar spine and sacrum in a boy aged 4 years (Figs. 5 and 6). This child had almost complete lateral rotation of all lumbar vertebrae and scoliosis to the extent that the sacral segments were lying horizontally. There was no union between the sacrum and the ilium on the left side and on the right the articulation was through the first and second sacral segments. The spinous processes of the second and third lumbar vertebrae were fused and from them a bony process grew back toward the ilium. Articulating with the center of the process, on the lower side, a bony mass, probably a remnant of the processes of the fourth and fifth lumbar vertebrae, passed vertically to articulate with the ilium. The pelvis was markedly deformed. Sensation was lessened on the left side. There was atrophy of the muscles of the lower extremities of the left side, and the child had never walked with-

out assistance. Sphincter control had always been lacking.

Case 5 (A164733). Congenital anomaly of the sacrum in a man aged 65 years (Fig. 7). The patient came to the Clinic because of a gastro-intestinal complaint. In routine examination a curved bony spur was revealed, growing from the left side of the fourth sacral segment downward for a distance of 4 cm., then turning at a right angle and crossing the coccyx to the right side. The patient did not have symptoms referable to this anomaly.

Case 6 (A348044). Congenital anomaly of the sacrum in a boy aged 10 years (Fig. 8). There was non-closure of the arch in the first sacral segment, a rudimentary third sacral segment, and an absence of the remaining sacral and coccygeal segments. He had had incontinence of urine since birth and cystitis since the age of 5. Pus in the urine, and evidences of renal infection had gradually increased.

Case 7 (A166658). Congenital anomaly of the fifth lumbar vertebra in a woman aged 37 years (Fig. 9). The body of the fourth lumbar vertebra was wedged with the thin edge toward the left. The right transverse process was small and directed upward, the left, which was longer and thicker,

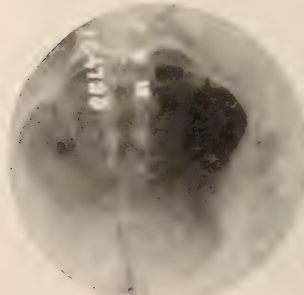


Fig. 7 (A164733). Congenital anomaly of the sacrum in a man aged 65 years.



Fig. 8 (A348044). Congenital anomaly of the sacrum in a boy aged 14 years.

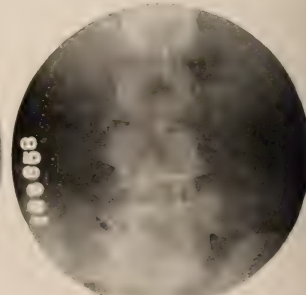


Fig. 9 (A166658). Congenital anomaly of the fifth lumbar vertebra in a woman aged 37 years.

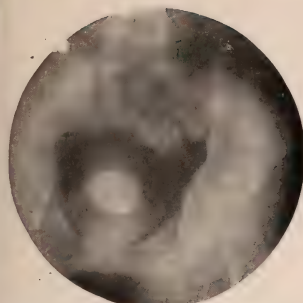


Fig. 10 (A263178). Congenital anomaly of the sacrum in a boy aged 14 years.

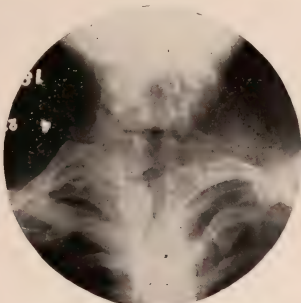


Fig. 11 (A199711). Spina bifida occulta of the cervical and thoracic regions.



Fig. 12 (A203099). Spina bifida in cervical region.

was directed horizontally. The fifth lumbar vertebra was wedge-shaped with the thin edge to the right. The transverse process on the right was thin, small, and directed obliquely upward. Two transverse processes came from the left side of the vertebra; the lower was small and curved. The right ala of the sacrum was normal in size, while the left ala was less than half normal size. The pelvis was tilted to compensate for the wedging of the fifth lumbar vertebra. For ten years this patient had suffered from more or less constant backache, with intense pain at times between the hips and at the tip of the coccyx on attempting to rise.

Case 8 (A263178). Congenital anomaly of the sacrum in a boy aged 14 years (Fig. 10). Development of the right half of the sacrum was rudimentary, but the left half was overdeveloped, resulting in marked displacement of the sacrum toward the left. A soft tumor in the back over the region of the sacrum was found with neuro-

logic evidences of spina bifida. The child had never had sphincter control and had had bilateral club feet from birth.

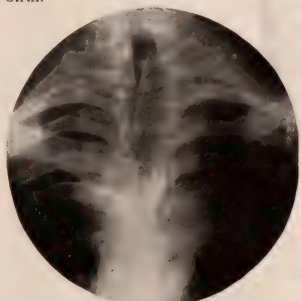


Fig. 13 (A261052). Spina bifida in the upper thoracic and cervical regions.

SPINA BIFIDA

Chute, in 1918, reported cases of retention of urine associated with defects of the sacrum, probably spina bifida occulta, and Marshall, in 1919,

reported a case of acute sprain of the spine followed by retention of urine. Woltman, in 1920, reviewed the literature and discussed the condition. He noted the occasional difficulty in the diagnosis of the occult variety. He discussed fully the various theories of the cause of this disease and concluded that it could not be explained on the basis of any single factor, but on one or more of the following: (1) abnormal character of the gametes, (2) mechanical, chemical, or physico-chemical factors influencing the embryonic rudiments, either before or after differentiation. He pointed out the roentgenologist's tendency to disregard the finding, and discussed the associated signs and symptoms. A series of reflex disturbances, faulty contour or slight asymmetry of development of the calves or buttocks, and deformities of the foot and toe often may be explained by spina bifida occulta. Hypertrichiasis is only infrequently associated; sacral dimple, persisting after 12 years of



Fig. 14 (A268500). Congenital defect in the third and fourth thoracic vertebra with no signs or symptoms.

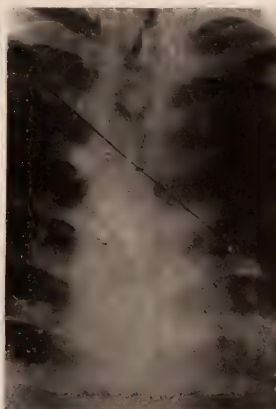


Fig. 15 (A316979). Spina bifida in the thoracic vertebra.

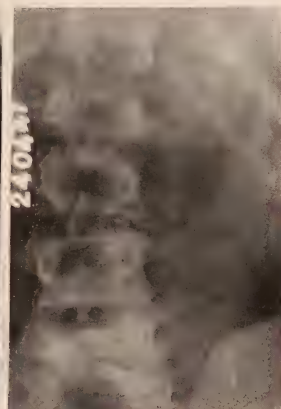


Fig. 16 (A240447). Spina bifida presenting signs and symptoms.

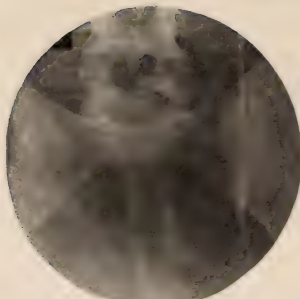


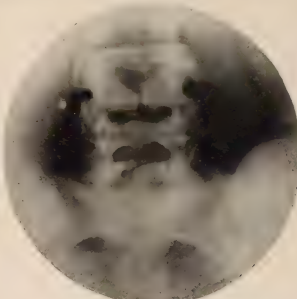
Fig. 17 (A293929). Spina bifida presenting signs and symptoms.

age, is significant. Disturbances of sphincter control are common, as are motor paralysis and sensory disturbances, which in no instance occur independently. Incontinence sometimes develops later in life. Enuresis, though repeatedly reported as being associated with spina bifida, was uncommon in Woltman's series. Trophic ulcers in the feet were sometimes noted after the fifteenth year.

SPINA BIFIDA IN THE CERVICAL AND UPPER THORACIC REGION FIVE CASES

Case 9 (A199711). A roentgenogram (Fig. 11) of a woman, aged 21 years, showed the laminae on the left side of the first, second, and third thoracic vertebrae to be undeveloped, and the body of the seventh cervical vertebra much thicker on the left side than on the right. There was also a lesion on the second, third and fourth lumbar vertebrae, which suggested a congenital defect. The patient had had a torticollis since birth; the chin was turned to the right.

Case 10 (A203099). A roentgenogram (Fig. 12) of a girl, aged 14 years, showed the left sides of the fourth and fifth cervical vertebrae to be defective, and a tumor in the neck corresponded to this area. The girl was operated on for spina bifida in the Clinic. Neurologic examination showed



Figs. 18 and 19 (A341129). Spina bifida presenting signs and symptoms.

decreased development of the left thigh and calf, pes equinus, general muscular weakness, and some incoordination.



Fig. 19.

Case 11 (A261052). A roentgenogram (Fig. 13) of a man, aged 32 years, revealed absence of the laminae of the seventh cervical and first thoracic vertebrae on the right side. He

had a hairy mole in the middle line between the scapulae. There was some muscular weakness and atrophy in the left arm.

Case 12 (A268500). A roentgenogram (Fig. 14) of a man, aged 39 years, revealed a congenital defect in the third and fourth thoracic vertebrae. The right lamina of the third vertebra was absent, and the right lamina of the fourth vertebra was definitely increased in width. The patient did not have symptoms referable to the defect.

Case 13 (A316979). A roentgenogram (Fig. 15) of a man, aged 38 years, revealed congenital absence of the lamina on the right side of the second thoracic vertebra. Spina bifida of the meningocele type, with a hairy mole over it, had developed at the seventeenth year. Neurologically his symptoms were objectively negative.

SPINA BIFIDA OCCULTA

Roentgenographic examination of the lumbar spine and sacrum has been made in approximately 12,000 of a consecutive series of 70,000 patients in the Mayo Clinic. Six hundred and twenty-one of the 12,000 had spina bifida occulta, showing an incidence of slightly more than 5 per cent. The condition occurred about twice as often in the male as in the female. The defect was in the first one or two sacral segments in 70 per cent, in the fifth lumbar segment in 24.5 per cent, and in the lower sacral segment in 3 per cent. Associated spina bifida occulta and bifurcation with sacralization of the transverse process of the fifth lumbar vertebra occurred in 2.5 per cent.

SEVEN CASES PRESENTING SIGNS AND SYMPTOMS OF SPINA BIFIDA

Case 14 (A240447). A man, aged 35 years, had had a trophic ulcer on the right foot for four years and a bulging in the sacral region with a palpable defect of the spine (Fig. 16). Until the age of 10 he had had no control of the rectal sphincter.

Case 15 (A293929). A child, aged 4 years, had club feet and webbed

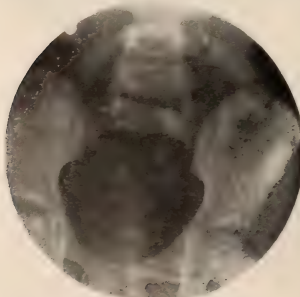


Fig. 20 (A268003). Spina bifida presenting signs and symptoms.

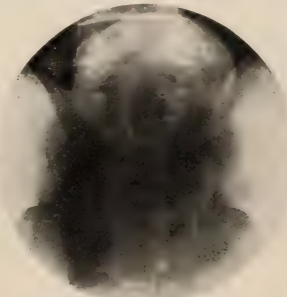


Fig. 21 (A280908). Spina bifida presenting signs and symptoms.

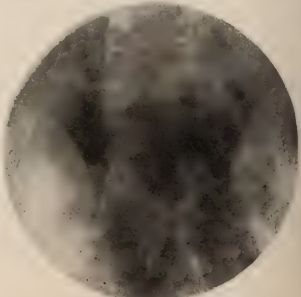


Fig. 22 (A13603). Spina bifida presenting signs and symptoms.

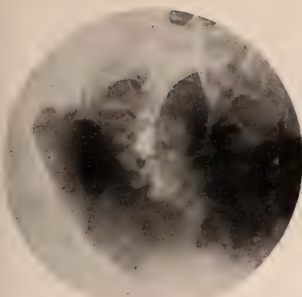


Fig. 23 (A260462). Spina bifida presenting signs and symptoms.



Fig. 24 (A191159). Spina bifida without signs or symptoms.

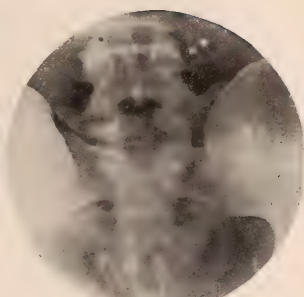


Fig. 25 (A268039). Spina bifida without signs or symptoms.

toes at birth. He had no other neurologic signs of the defect (Fig. 17).

Case 16 (A341129). A woman, aged 38 years, had a sharp depression in the upper lumbar spine; the lower lumbar region was covered with long hairs. She had no other signs or symptoms referable to the defect (Figs. 18 and 19).

Case 19 (A13603). A woman, aged 49 years, had a cystic mass, tender to pressure, over the lumbar region in the back, an ulcer on the plantar surface of the left foot, and atrophy of the muscles of the left calf and thigh (Fig. 22).

Case 20 (A260462). A man, aged 26 years, had a soft, fluctuating tumor

areas over the buttocks (Fig. 23).

In the 621 cases reported, only a small number of the patients had signs or symptoms referable to the defect. Many cases occurred in patients who had some definite pathologic condition and the finding of the spina bifida was an incident in the routine examination. Had the patients been subjected to a careful

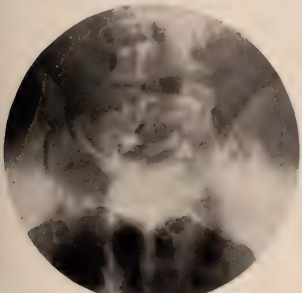


Fig. 26 (A272753). Spina bifida without signs or symptoms.

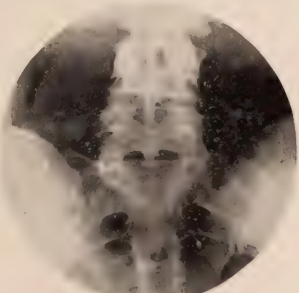


Fig. 27 (A275851). Spina bifida without signs or symptoms.

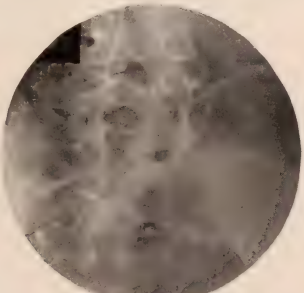


Fig. 28 (A285697). Spina bifida without signs or symptoms.

Case 17 (A268003). A girl, aged 6 years, had a syringomyelocoele. The condition was diagnosed at operation (Fig. 20).

Case 18 (A280908). A man, aged 32 years, had a myelomeningocoele; his condition was also diagnosed at operation (Fig. 21).

over the middle area of the sacrum. Incontinence of urine and feces had persisted since birth, and he did not walk until four or five years of age. The patient had pes cavus, hammer-toes, moderate reduction of strength in the rotatores of the thigh and in the muscles below the knee, and anesthetic

neurologic examination no doubt a percentage would have shown signs or symptoms of the condition. There was a wide variation in the types of defect and there seemed to be little relation between the extent of the defect and the signs or symptoms. Some patients with small defects had definite symptoms,

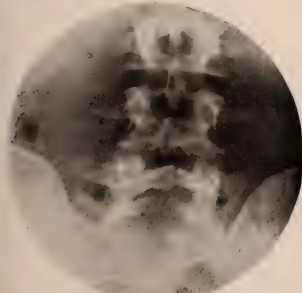


Fig. 29 (A307240). Spina bifida without signs or symptoms.

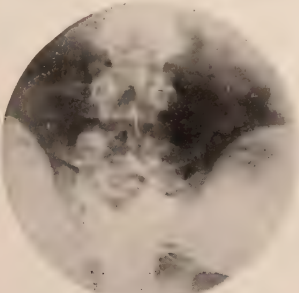


Fig. 30 (A327576). Spina bifida without signs or symptoms.

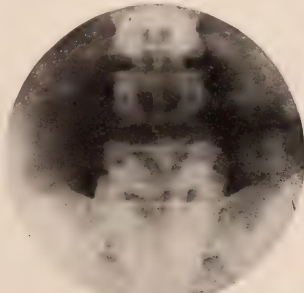


Fig. 31 (A334393). Spina bifida without signs or symptoms.

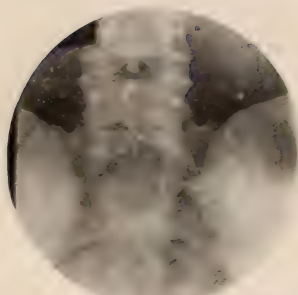


Fig. 32 (A337687). Spina bifida without signs or symptoms.

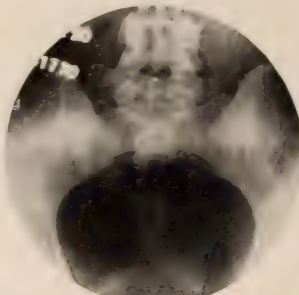


Fig. 33 (A341170). Unilateral type of bifurcation and sacralization.

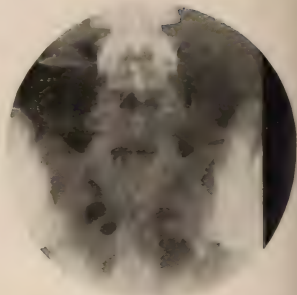


Fig. 34 (A258472). Unilateral type of bifurcation and sacralization.

while others with larger defects did not show symptoms.

I have chosen nine roentgenograms showing defects without any clinical findings traceable to the defect. (Cases A191159, A268039, A272753, A275851, A285697, A307240, A327576, A334393 and A337687, Figs. 24 to 32).

BIFURCATION AND SACRALIZATION OF THE TRANSVERSE PROCESS OF THE FIFTH LUMBAR VERTEBRA

Adams, in 1910, reported a case of scoliosis relieved by operation on the transverse process of the fifth lumbar vertebra, and in 1914 he reviewed the relation of bony anomalies of the lumbar spine to scoliosis. Forty-four of fifty consecutive cases showed bony defects in the sacrum, or two lower lumbar vertebrae. He quoted various authors in accord with his own findings, and noted the importance of anomalies of the articular processes as factors.

He found anomalies of the fifth lumbar vertebra so often that the normal was doubtful. Goldthwaite, in 1913, reviewed the various forms of anomalies found in the lumbosacral region and brought forward anatomic explanations for many cases of weak or painful back and for many paralyses of the leg. Henderson, in 1914, presented a study of bifurcation of the transverse process of the fifth lumbar vertebra and quoted various authors for and against the costal-element theory of the lumbar transverse process. Richard, in 1919, found that 60 per cent of 60 patients with pain in the lumbosacral region had slight or pronounced malformations of the transverse processes of the fifth lumbar vertebra. The malformation was in contact with the sacrum or iliac bones on certain movements in two groups, with the formation of a bursa in one, and with definite joint formation in one. He pointed out that ossification

and union of the segments was not complete until about the twenty-fifth year, which accounted for the development of symptoms after these years. O'Reilly, in 1921, published interesting observations on the anatomic variations of the lumbosacral region and in a later paper compared the roentgenographic findings with the findings at necropsy in 28 male cadavers. In the anatomic variations he found types common to both sexes; some types were common to males and others to females. Asymmetry was the predominating feature, but the actual amount of asymmetry was less than appeared in the roentgenogram. In several cases a heavy line ran along the edge of the first sacral vertebra, which in the roentgenogram suggested displacement of the fifth lumbar vertebra, but on dissection proved to be arthritic lipping. In O'Reilly's experience the roentgenogram rarely gave an adequate idea of the extent of the arthritic changes.

In a series of 12,000 roentgenograms of the spine, I found reports of 527 bifurcations and sacralizations of the fifth lumbar transverse processes. This suggests an incidence of the anomaly of approximately 4.5 per cent. I have divided the anomalies into four types: the unilateral (Cases A341170, A258472, A293983, and A258117, Figs. 33 to 36), in which there were 23.17 per cent males and 33.54 per cent females, the bilateral (Cases A274736, A173574 and A267743, Figs. 37 to 39), in which there were 6.7 per cent males and 14.05 per cent females, the fish-tail (Case A350845, Fig. 40) in which there were 4.27 per cent males and 6.10 per cent females, and the high sacral (Cases A164905 and A212650, Figs. 41 and 42), in which there were 3.35 per cent males and 8.82 per cent females. It is apparent that this anomaly occurs in about the same ratio as spina bifida occulta, two in the female to one in the male.

I have found a few cases of bifurcation of the transverse processes other



Fig. 35 (A293983).—Unilateral type of bifurcation and sacralization.

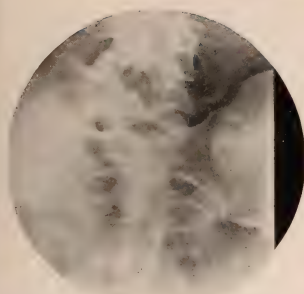


Fig. 36 (A258117). Unilateral type of bifurcation and sacralization.

than those of the fifth lumbar, with articulation of two processes through the bifurcation (Case A297087, Fig. 43).

The study of the symptoms in this series of cases was difficult, since in the majority the anomaly was co-existent with other pathologic conditions capable of causing about the same kind of pain that might be expected from the anomalies. The characteristic symptom seems to be dull, aching pain low in the lumbar region, increased in severity by certain movements, and pain in the hips and legs. Only a small percentage of the series presented definite evidence of symptoms referable to the defect.

In the literature may be found occasional reports of benefit derived from operation; but the opinion of most investigators seems to be for conservatism in the surgical treatment.

SUMMARY

1. Defects in the upper spine are rare.
2. Defects in the last lumbar and the sacral vertebrae are frequent.
3. In a large majority of cases these defects are clinically negative.
4. Clinical findings, when present, include: Disturbances of sphincter control; motor paralysis and sensory disturbances; incontinence, sometimes de-



Fig. 37 (A274736). Bilateral type of bifurcation and sacralization.

veloping after puberty; enuresis; trophic ulcers; deformities of the foot or toe and slight asymmetry of development in the muscles of the lower extremities; hypertrichiasis, infrequently associated; and sacral dimple, significant if persisting after 12 years of age.

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Fig. 38 (A173574). Bilateral type of bifurcation and sacralization.

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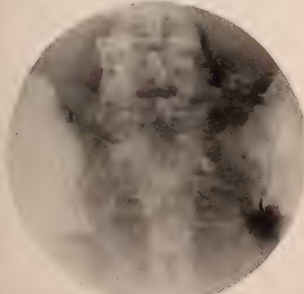


Fig. 39 (A267743). Bilateral type of bifurcation and sacralization.

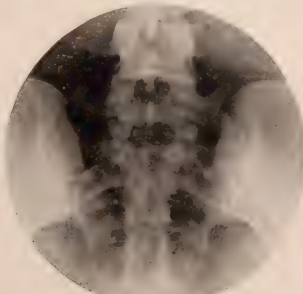


Fig. 40 (A350845). Fish-tail type of bifurcation and sacralization.



Fig. 41 (A164905) and 42 (A212850). High sacral types of bifurcation and sacralization.

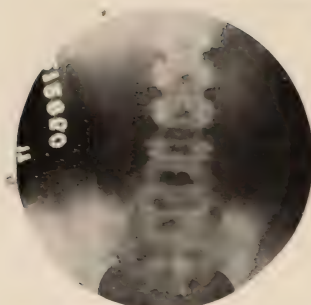


Fig. 42.

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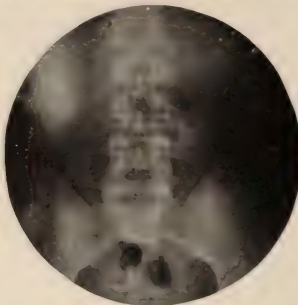


Fig. 43 (A297087). Bifurcation of the transverse process of the third vertebra and articulation with the fourth.

ing three associated cases of myelodysplasia without demonstrable bony defect. *Minnesota Med.* 4:244-259, April, 1921.

DR. LEWALD: This is a most remarkable collection of cases of anomalies of the spine. I thought I had a few, but they are very few compared to these. There are two questions which I would like to have cleared.

First, are any of these types transmitted as an hereditary characteristic?

The second question is in regard to the association between incontinence of urine and defects in the spine as suggested by Shoot. I was not clear as to whether Dr. Sutherland had worked that out to his own satisfaction.

DR. WALLACE: I want to say a word. We ran across, two weeks ago, a case of six lumbar vertebrae, and I do not know how common or uncommon that may be. I came in when this paper was half finished. It may have been mentioned. The fifth lumbar vertebra was perfectly formed and the sixth was as mature as a great many you see in the fifth, with the transverse process and spinous process perfectly well formed. It is an anomaly that I had not seen before.

DR. ULLMANN: I should like to ask what proportion of sixth lumbar? It is not uncommon to pick up sixth lumbar and wonder whether it is first sacral lumbarized through that term. When you get six lumbar and six or seven sacral, you don't know whether you have a lumbarized first sacral or a sacralized sixth lumbar.

DR. SUTHERLAND: I personally did not take up the question of heredity as regards these congenital defects. I will send Dr. LeWald Dr. Woltman's article. I think he takes up the family history in a good many cases.

As regards incontinence, I think that is almost the commonest symptom of spina bifida occulta. That is one of the symptoms which Woltman lays a great deal of stress upon in his work.

As regards sixth lumbar, this series included a great many routine examples of the kidney, urine and bladder and in getting out my series I only retained what we speak of as the pelvic plate, so I did not go into the question of sixth lumbar. We do see it, not too frequently, but rather frequently. I would say that numerical variations in the vertebra were comparatively common if they were traced. Just the proportion I am sorry I am not able to give.

Positional Anomalies of the Gastro-Intestinal Tract*

MAXIMILLIAN JOHN HUBENY, M. D.

Chicago, Illinois

THE artifices of diagnosis are so alluring that when several different opinions are rendered, which opinions are based upon the same evidences, one wonders at the sophistries of logic. Logic is the science, art or laws of exact reasoning, however, a large amount of flexibility is introduced into the domain of medicine, or anything pertaining thereto.

In substituting tangible evidences for sophistications, the deductions are of a more substantial nature.

The roentgen examination has been a powerful factor in attaining this end, for by its aid a pictorial display is

substituted for the vagaries of a diagnosis based principally on other insecure findings. Of course, the question of personal equation is a factor which must always be considered in evaluating a decision or opinion.

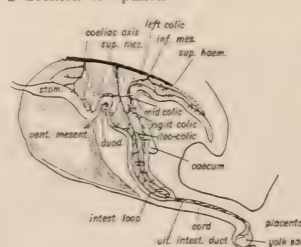


Fig. 1.—Human alimentary canal in the fifth week of embryonic life. (Diagram from Keith.)

Not so long ago it was a generally accepted belief that the thoracic and abdominal viscera occupied a relatively constant position and relationship, however, today this is not accepted in toto. Different classifications have been ad-

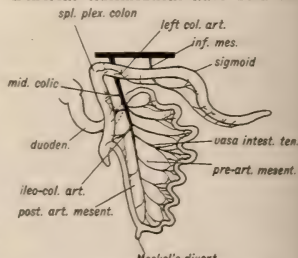


Fig. 2.—Human alimentary canal in the third month of embryonic life. (Diagram from Keith.)

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

verse type, in which the longest cardiac dimension tends to be transverse. A curious illustration and one that is not infrequent is complete transposition of the thoracic and abdominal viscera. To account for this atavism might bear serious consideration.

It is now accepted, that the abdominal viscera also has variations from the usual conception of what constitutes normal position and relationship. George Johnston aptly remarked that he wouldn't care if his stomach were down in his toes as long as it functioned properly; this epitomizes the object of this paper. Many an innocent stomach has been lifted up and numerous mobile ceca have been unnecessarily anchored because of false notions regarding positions and movability. The opinions regarding the situations of the gastro-intestinal tract are just emerging to a sane plane and considerable judg-



Fig. 3.—The above figure shows a condition frequently seen when the first few feet of the jejunum pass to the right: (j) is on the commencement of the jejunum. The arrows indicate the direction of intestinal flow.

vanced, but these are somewhat arbitrary; the attempt towards classification and standardization is salutary, but considerable latitude must be observed in reaching conclusions. This is well appreciated today as pertains to the stomach. After all, anatomic variations *per se* are not so important, only as they indicate potential harmful possibilities, when considered from the view point of incompatibility between anatomic topography and physiology.

We are all aware of the variations of the principal thoracic structures such as the heart and the aortic arch, and the impression is vivid that the conformation and the relationship of these is normally influenced by the size and shape of the individual. Two extremes may be cited, such as the asthenic type, in the tall, thin and narrow shouldered individual, and the trans-

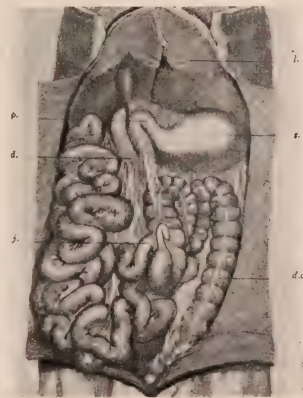


Fig. 5.—Complete non-rotation of intestine: (p.) pylorus, (d.) duodenum, (j.) ileocolic junction, (l.) liver, (s.) stomach, (d.c.) descending colon. (From Huntington.)

ment is necessary to enter a decree of former pathology. We all remember the former prevalence of nephroproxy and its present limited usage; so, deterrent forces are necessary to prevent unnecessary mutilation of innocent organs.

Most human beings are born singularly perfect and apparently free from anatomical abnormalities. Yet a tour of observation through any dissecting room will reveal anomalies present in most bodies on the table. This applies especially to the arterial system, more particularly to the visceral arteries.

The x-ray examination gives us antemortem information of inestimable value and consequently has altered many accepted notions.

The purpose of this paper is not to include positions affected or accomplished by inflammatory reactions, but

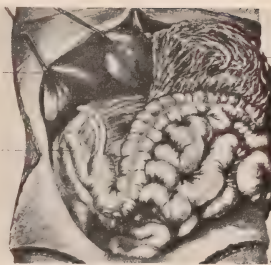


Fig. 6.—Arrested rotation of intestine: (l.) liver, (t.) terminal ileum, (g.o.) great omentum. (From Huntington.)

to consider the subject from the standpoint of embryology.

To understand these abnormalities, it is necessary to visualize clearly the step of peritoneal rotation, descent and fusion and the changes in the respective positions of the large and small intestines during the process.

In the fifth week of embryonic life the foregut is firmly fixed by both dorsal and ventral mesenteries. The mid and hind guts are slung up to the posterior body wall by their dorsal mesenteries only. The ventral mesenteries have disappeared. The mesentery of the midgut is long and the intestinal tube forms a long U loop from the convex end of which the vitelline duct passes through the umbilical opening to the yolk sac. Where the limbs of the U loop the fore and hind guts, there are acute bends, and the gut has little mobility above and below these points. The U loop which is supplied by the superior mesenteric artery, is not able to move very freely in a lateral direction, because its apex is fixed by the attachment of the vitelline duct to the umbilicus. It is, however, able to rotate around its base where the two limbs of the U are close together. After the fifth week the midgut increases in length very rapidly, far out-stripping



Fig. 4.—Arrested rotation of intestine: (l.) liver, (d.) duodenum, (s.i.) small intestine, (sp.) spleen, (s.) stomach, (s.f.) splenic flexure, (t.c.) segment corresponding to transverse colon, (a.c.) ascending colon, (j.) ileocolic junction, (a.) appendix. (From Huntington.)

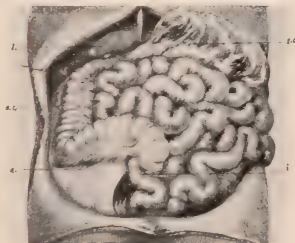


Fig. 7.—Arrested rotation of intestine: (l.) liver, (a.c.) ascending colon, (a.) appendix adherent to lateral aspect of ascending colon and to iliac parietal peritoneum, (g.o.) great omentum, (t.) terminal ileum. (From Huntington.)

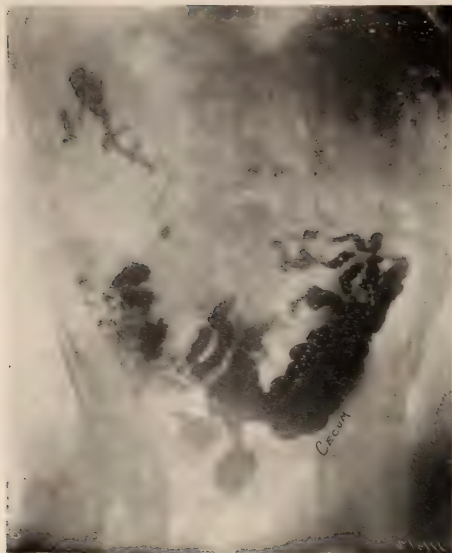


Fig. 8.—Shows position of cecum in true pelvis six hours after ingestion of opaque meal.



Fig. 9.—Same patient as in Fig. 8. Shows mobility of cecum; it was elevated from the true pelvis by manipulation and held in this position while plate was taken. Roentgenological diagnosis of appendicitis was verified. Symptoms were relieved. A mobile cecum need not be pathological *per se*; sometimes because of torsion or lack of peritoneal rotation the ileum may enter the cecum in such manner as to produce angulation with obstruction. Considerable surgical judgment is required to determine cecal anchorage.

the other divisions of the alimentary canal. Its mesentery becomes fan shaped and capacious except at the base of the loop, where the limbs of the U join the rest of the gut. Here the mesentery is reduced to a narrow isthmus, through which the superior mesenteric artery passes. At the beginning of the third month the U shaped loop twists round on this isthmus from right to left. By this twist the hind gut near the limb of the U is carried upward and to the left toward the splenic region, where it adheres and forms the splenic flexure of the colon. The rest of the colon proximal to this

swings over the front of the abdominal cavity from left to right, becoming attached

to the structures on the posterior body wall along a line extending from the left to the right kidney and thence down to the right iliac fossa. As the twist affects the limbs of the U loop at the isthmus, the proximal part of the midgut entering the loop is carried to the left behind the colon, and the rest of the loop twists in the same direction, so that it comes to lie free in the abdominal cavity, below the colon with its

mesenteric partly reversed, the anterior face of the mesentery representing the right side of the dorsal mesentery and the posterior face its left side. At the same time the superior mesenteric artery comes to lie in front of the commencement of this part of the gut and marks the line of separation between the duodenum and jejunum. The effect of this twist is to carry the right side of the dorsal mesentery of the duodenum

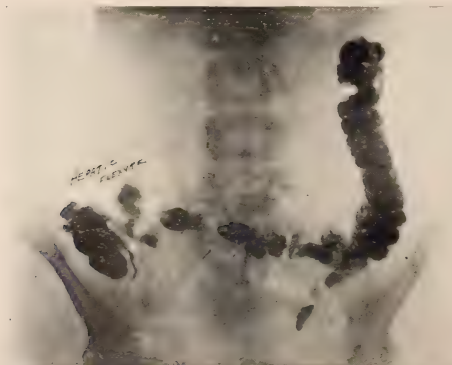


Fig. 10.—Low hepatic flexure, relatively high splenic flexure, short ascending colon.

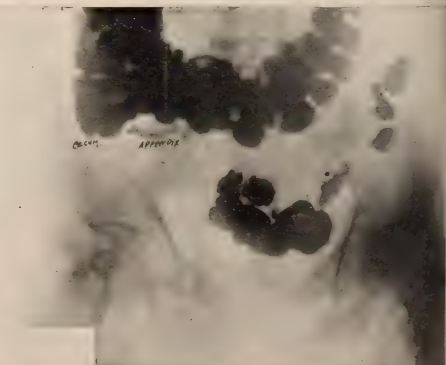


Fig. 11.—Partial descent of cecum.



Fig. 12.—Wide hepatic flexure, relatively high position.

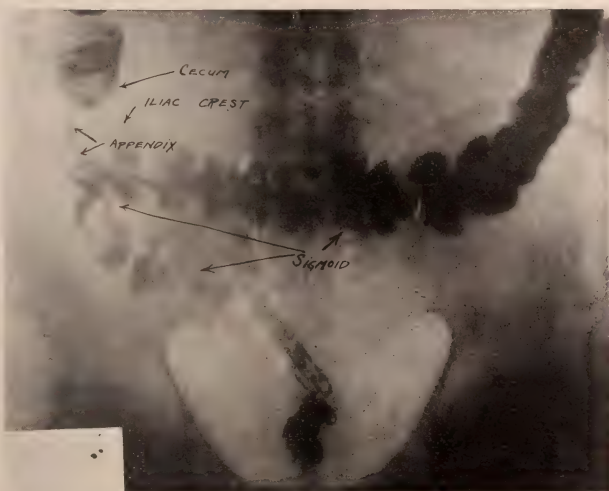


Fig. 13.—Pelvic colon, situated near level of crest of ileum. Might be surmised to be the transverse colon. Cecum and appendix seen above iliac crest.

against the posterior body wall, where it becomes attached. On reflection, it will be evident that the rotation of the U shaped loop of the intestine, followed by its adhesion to the posterior body wall, is responsible for the obliteration of the lateral spaces of the body cavities on both sides of the dorsal mesentery of the upper end of the foregut (second and third parts of the duodenum). The splenic flexure of the colon comes to lie in front of the left kidney and the hepatic over the right, while the ascending and descending colons lie in the right and left flanks.

Peritoneal adhesions form between the colon and its mesentery and the posterior body-wall, which fix the left face of the gut and mesentery to the parietal peritoneum. The right face of the mesocolon becomes the anterior face, which lies in the concavity of the free colonic loop. It is continuous along the line of the ileocolic artery with the right face of the mesentery of the small intestine. The process of fixation is probably exactly analogous to that occurring in inflammatory processes. In most cadavers irregular lines of union, leaving many pockets and crevices can be seen along the outer sides of the ascending and descending colons. At the splenic flexure, the union is very firm, being strengthened by a special band of tissue, which passes from the diaphragm and the tip of the eleventh rib to the gut (costocolic ligament). Proximal to this the fixation is less substantial. The attachment of the transverse mesocolon to the pancreas and the second part of the duodenum is quite loose and the long mesentery allows great mobility to the transverse colon. The hepatic flexure is more firmly fixed to the tissues in front of the right kidney, but there is no strong ligament on this side analogous to that fixing the splenic flexure. The ascending colon and cecum unite fairly firmly with the posterior body wall below the right kidney.

There are four principal processes involved: First, migration; second, rotation; third, descent; fourth, fixation. Variations in these normal processes may occur by excess or defect.

The cases where the first two feet or so of the jejunum pass to the right are worth notice, as it has a special bearing on the technique of the no-loop operation of gastrojejunostomy as practiced in the Mayo operation and would call for a reversal of the manner of placing clamps on the jejunum.

Every operator expects the viscera to occupy normal positions, and if he fails to find the organ he is searching for he hunts for it where previous experience has taught him he is most likely to find it. If he has been care-

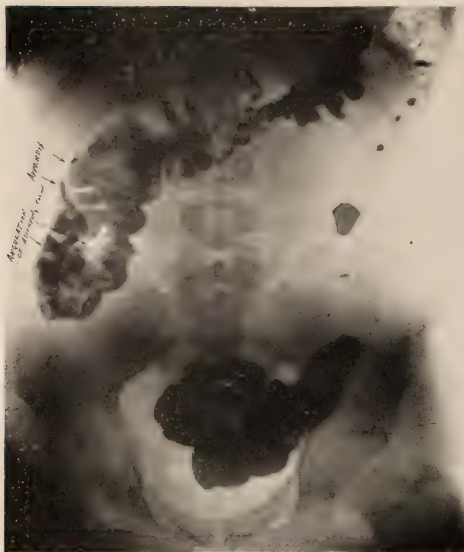


Fig. 14.—Cecum and portion of ascending colon apparently turned up and out upon upper portion of ascending colon. The appendix is seen near the hepatic flexure. Previous diagnosis of gall-bladder disease was made. Roentgenological diagnosis of appendicitis was verified. Relief was obtained. No attempt to correct location of the appendix was made, because it was apparently a case of arrested development. Potentially, it appears bad.

fully trained in embryology he might surmise where to look and what to observe, and if not he begins to hunt over the greater part of the abdomen, with dire consequences to the patient.

In some cases the first and second parts of the duodenum are situated usually far to the right, and if only a gastric examination is made following the ingestion of an opaque meal an error in diagnosis is highly probable,

for in certain instances it has been proven that an appendix was the cause of trouble and this was only discovered after a complete gastro-intestinal x-ray examination revealed the presence of an



Fig. 15.—Unusual location of both flexures, descending iliac and pelvic colons. Roentgenological diagnosis of appendicitis was surgically verified. Patient completely relieved.

anomaly. Pfahler's dictum of a complete gastro-intestinal examination should always be heeded, for such obvious reasons as just illustrated.

The colon offers

many opportunities for variations. As regards migration the intestine might remain either in whole or in part without the abdominal cavity or pause at any point along its developmental path; such deficient migration is a matter of common surgical knowledge, in which the cecum may be found on the left side.

The variations in rotation concern the manner in which the colon and its

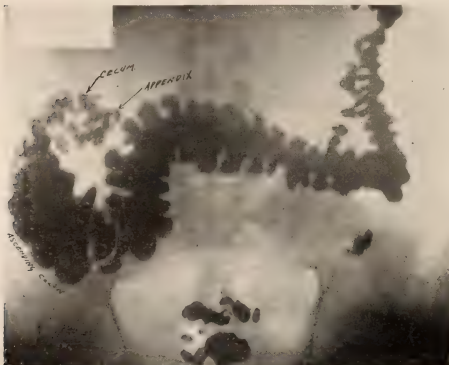


Fig. 16.—Inverted cecum, ascending colon and appendix. Simulated duodenal ulcer. Surgical removal of appendix verified roentgenological diagnosis, with relief of symptoms.

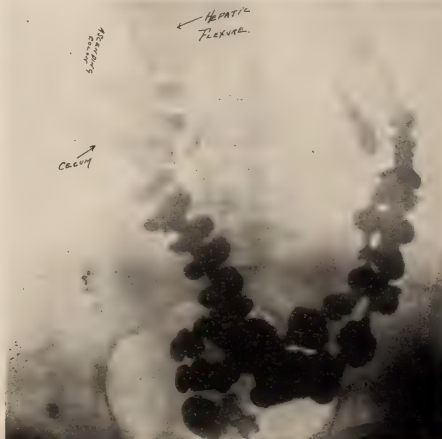


Fig. 17.—High situation of cecum and hepatic flexure. Short ascending colon. Roentgenological diagnosis of appendicitis verified. Previous diagnosis was gall-bladder disease.

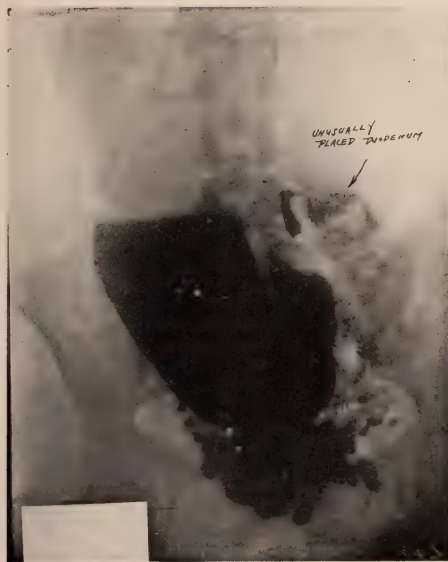


Fig. 18.—This and the two figures immediately following are of the same patient. Clinical diagnosis was duodenal ulcer. Roentgen examination of stomach and duodenum only was requested, however, by suggestion, a complete gastro-intestinal examination was performed, with an ultimate diagnosis of appendical involvement. This was surgically verified. This is an interesting anomaly, the cecum lies up in the hepatic region, is inverted, and goes down as the ascending colon, then is continuous with the transverse colon. See Fig. 19 and Fig. 20. This illustrates the necessity of complete examination of the gastro-intestinal tract.



Fig. 19.—This is the 24-hour sequel showing the location of the cecum. See Fig. 18 and Fig. 20.

rotation may be deficient or excessive. In the first event the ileum would enter from the right and posteriorly, and in the latter case, anteriorly. In abnormal rotation, combined with fixation, the ileum can hardly escape being kinked.

The normal position of the cecum is said to be in the right iliac fossa, resting on the iliac fascia, covering the ilio-psoas muscle, above the outer part of Poupart's ligament, about half below and half above the level of the anterior iliac spine. But minor variations are usually found. As regards the normal position there may be hypo-descendent or hyperdescendent. In hypo-descendent the cecum lies anywhere between the region of the liver and its normal site. If the cecum goes beyond its normal position into the pelvis or develops such proportions that it is possible for it to lie in the pelvis, it is said to be hyperdescendent.

Hyperdescendent ceca may be divided into two groups, depending upon whether the colon is attached to the parietal wall or has a mesentery. This is interesting, as is frequently assumed that when a cecum is found in the pelvis, it is evidence of ptosis. This we are not inclined to accept; it occasionally happens that a long mesen-

tery is present, which permits considerable mobility. Bearing this in mind it will explain the presence of so-called "phantom

pelvic tumors" as elicited upon vaginal examination.

The process of fixation is a physiological fusion of contiguous peritoneal surfaces and offers numerous variations. Harvey divides these into hypo-fixation and hyper-fixation. When hypo-fixation is present a mesentery might be found; combining this with a disproportionate linear development of the large bowel, many positions of the colon, either in part or in whole can be expected.

The favorite sites for variations are the cecum, hepatic flexure, transverse colon, splenic flexure, the descending colon at the level of the iliac crest and the sigmoid. The splenic flexure is of particular interest, as it occasionally runs up as high as the diaphragm, and when filled with food may simulate a tumor mass on palpation and percussion; sometimes gas may replace the bowel contents when tympany is elicited, both these conditions might be misleading if the location of the colon were not known.

The above summary supported by some valuable clinical experiences would lead the writer to conclude that considerable reflection is necessary before pronouncing pathology present, as

evidenced by variations in size, shape and position.

Great surgical discretion is required for the protection of the best interest of the patient and symptoms confirming roentgenological findings should be present before instituting such procedures as colonic resections, extirpations, anastomoses and organ suspensions and fixations.

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Fig. 20.—This is a radiogram following the ingestion of an opaque enema. This was done to be certain that the inferences made from the previous examination were correct. The cecum is high and inverted, the appendix is demonstrable. The ileo-cecal valve is incomplete. See Fig. 19 and Fig. 15.



Fig. 21.—This reveals location of opaque meal six hours after ingestion. Shows cecum and ascending colon near median line. Roentgenological diagnosis of appendicitis was surgically verified. Relief was obtained. See Fig. 22.



Fig. 22.—Opaque enema. This definitely verified previous examination. See Fig. 21.

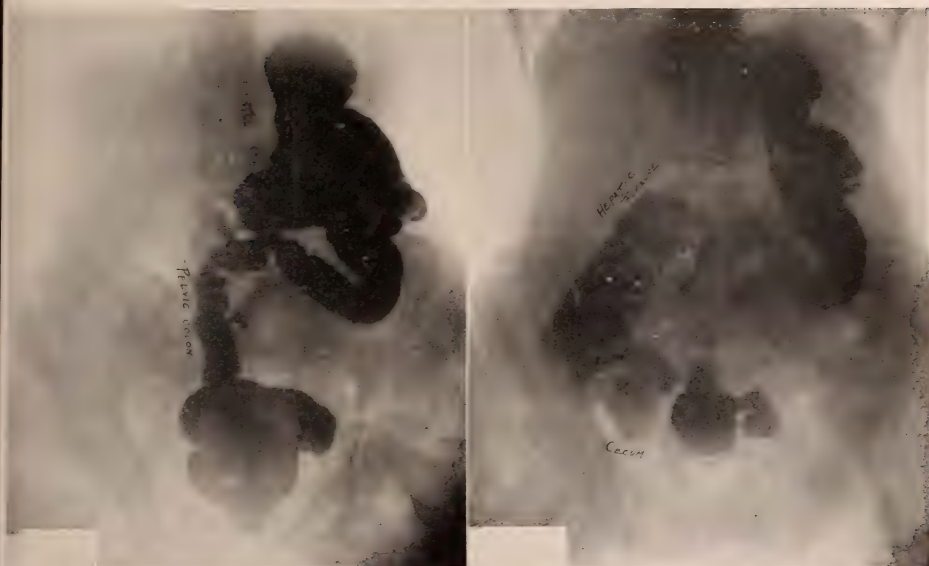


Fig. 23 and Fig. 24 are mates indicating the position of the large bowel. The location of the sigmoid, the flexures, and the ascending and transverse colons is unusual. Appendectomy gave relief from symptoms.

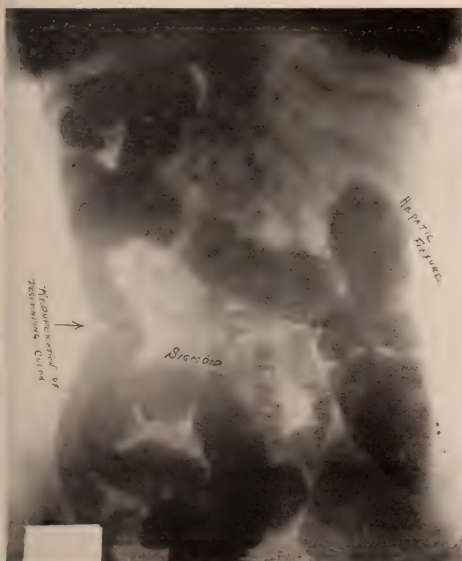


Fig. 25.—Redundancy of big bowel, particularly sigmoid. Arrow head indicates frequent seat of reduplication; in some cases obstructive symptoms occasionally occur.



Fig. 26.—Redundancy of sigmoid with spasm of reduplication of the descending colon at level of the iliac crest. No surgical interference was instituted. The acute colonic disturbance cleared up and has remained so for nine years.

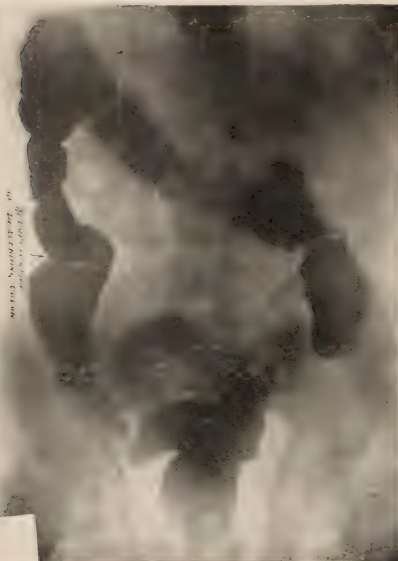


Fig. 27.—Redundant sigmoid. Occasional obstructive symptoms at region of the reduplication of the descending colon. When the intermittent obstruction comes on the patient assumes an accentuated Trendelenburg position, with consequent relief (presumably an unfolding of the kink). This has been going on for seven years.



Fig. 28.—Six hours after the opaque meal. Marked gaseous distension of distal colon. See Fig. 29.



Fig. 29.—Twenty-four hours after opaque meal. New growth present at reduplicated area on the descending colon. It is possible that anatomic variations may in some instances be potentially bad.

Recent Experiences in the Treatment of Mammary Carcinoma by Means of Heavily Filtered X-Ray*

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NOTWITHSTANDING the many promises held out to the public relative to the cure of cancer by its early removal, there is a definite skepticism on the part of many well informed, experienced individuals as to the permanency of cure in the majority of female sufferers from mammary carcinoma. It requires no great effort to secure records of unfavorable results in cases where radical surgical methods were instituted within a few days of the first indication of the disease. This skepticism increases proportionately as the time between diagnosis and removal.

We have no great occasion to congratulate ourselves on the management of such cases, and any proposal for improvement should meet with kind and earnest consideration. Surgery, as applied to mammary carcinoma, has been well standardized, while x-ray technique has not. It is not probable that the x-ray is destined to occupy either the middle ground between surgery and nothing or the twilight zones of pre-operative procedures and psychic or palliative measures. There is a deplorable lack of uniformity of opinion upon the use of the x-ray in treating cancer of the breast, and the need for substantial opinions upon this subject is most urgent. This may in part be due to the fact that the x-ray is an agent not sufficiently old to have become well established, but it is also the result of insufficient team work between roentgenologists and surgeons, and the utter lack of coordinated endeavor from within our own ranks. In keeping with this thought it seems timely to enter a plea for more exact data from those who contemplate a recital of their technique in x-ray treatments.

In reviewing this subject several startling statements have been noted. One author advocates multiple areas and a time factor representing more minutes than there are in a day. He makes no reckoning of time lost in changing areas or the need of refreshment. In another account it is recorded that treatments are given through one-half mm. of copper at a 20-inch distance for 50 minutes. The question naturally arises as to the reason for selecting 20 inches and this amount of filter when the maximum out put of ap-

paratus in use today will permit of much longer time at half this distance.

Quoting from another paper we learn that a 9-inch gap is scarcely sufficient to penetrate 6 mm. of aluminum. If this is true it is passing strange that the photographic effect through 12 mm. of aluminum is so pronounced when a 5-inch or less gap is employed.

A description of x-ray technique should leave nothing to imagination nor should imagination be permitted to supplant actual experience. An ambiguous statement which leaves ample room for speculation on the part of the reader is undoubtedly an attractive pecuniary measure, but reflects no great credit to an author and is partially responsible for varying opinions upon questions which ought to have been satisfactorily answered.

Among the first, if not actually the first, to employ the x-ray in malignant disease of this gland was a Washington roentgenologist (Merrill) and from that time up to the present, varying methods of its application with still greater variation in reports of success and failure have crept into the literature from every quarter of the world. The tendency has been in the direction of more intensive radiotherapy. In the beginning large areas were treated with no filter and modest dosage—this was followed by increase of filter, smaller areas, and increased radiation; and altogether constitutes an epoch in x-ray history. The advent of the Coolidge tube brought no very radical changes into this field excepting, only, a steady trend toward more intensive irradiation, and on the whole represented attempts at cancer destruction by fractional doses or the intermittent application of moderately filtered rays through multiple portals of entry.

Our interest in the subject of cancer treatment by means of heavily filtered x-rays with relatively high voltages, increased time and distance, through comparatively few skin areas, was stimulated by the essays of the last mid-winter meeting of this society and the application of the method followed immediately thereafter. And we have accumulated evidence which we believe points the way to more satisfactory results in the x-ray treatment of cancer of the female breast.

At the present time there is a growing tendency to regard the future of deep x-ray therapy as inseparably linked with voltages of at least twice what

have been used in the recent past. It would appear that we are about to don new and unknown garments without first having given the old a proper and befitting trial. It is a question if the capacity of present, universally distributed and reasonably uniform apparatus has been sufficiently and thoroughly tested and applied.

We discuss with much vigor the problems confronting us in the management of voltages ranging from 150 to 200,000, and speculation is rife as to the therapeutic consequences.

That unusual experiences are in store for us no one will deny; that newer methods and newer apparatus will come seems equally assured, but to await their development without first knowing the possibilities of apparatus at hand is, to say the least, unwise.

The physics of higher voltages is unquestionably interesting, and to the average roentgenologist similarly elusive.

No one knows in plain English phrases and figures how much electrical energy expressed in American volts is being delivered to x-ray tubes in other parts of the world, but we have observed during the past year the effects of x-ray treatments secured by passing 5 ma. through a Coolidge tube at a 9-inch gap, 10 and 12-inch distances, 1/2 mm. Cu filter, three hours time to each area, and it is to these procedures that your attention is directed.

We have met with the usual unsatisfactory experience in deep therapy for cancer, as a general proposition. Some few cases have responded to older methods with highly gratifying results, but the majority have succumbed to cancer.

The technique above referred to we adopted in February, 1921, and we have applied it generally to cancer of all types and parts excepting the superficial skin epitheliomas. However, its use was restricted in the beginning to recurrent carcinoma of the breast, and it is with carcinoma of the breast that the observations in this communication are concerned.

After a few preliminaries we began this treatment of postoperative recurrent cancer of the breast through three or more portals of entry, giving to each area a full three hours time. It was our aim to include in every case all of the affected side, both front and back, the supra-clavicular and axillary spaces, and when deemed best the op-

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

posite breast as well. Thus a patient would receive nine or more hours of x-ray, given as rapidly as possible. We found, however, that a maximum of one and one-half hours was sufficient on any one day for the average patient.

It is not unlikely that a technique will be worked out whereby the patient will be treated for the full time over one area, or three hours, but for the present this is not being done, and unless measures directed to the control of x-ray sickness are suggested, it will in certain instances be an insurmountable difficulty. X-ray sickness generally under this treatment seems to be not more violent, but is more prolonged. In this connection one of our cases vomited excessively after forty minutes of treatment, notwithstanding the fact that the usual measures had been used to prevent it, and another who had previously received the most intensive raying by the old method without having experienced even nausea, was extremely nauseated during her first prolonged treatment, vomited profusely afterward, continued vomiting at intervals that day, and was very ill for a week. Still another, a young colored woman, has experienced only anorexia after treatment for a few days, although she has received more hours to date than any other patient.

The effects upon the skin vary from a roughened, bran-like elevation of the epidermis to actual vesiculation, with slipping of the skin in several instances, but the ultimate result is a varying shade of brown with a smooth, somewhat thickened integument. In the blacks the skin takes on a deeper pigmentation.

Palpable tumors respond early, and in our experience without a single exception. Their decrease in size and induration is synchronous and progressive, beginning to reduce and soften within ten days. Recurrent nodes of the size of small marbles have disappeared in a month, leaving no trace whatever. In one instance five radium needles were buried in both sides of a recurrent lump, approximately the size of a lemon, for twelve hours to the side and subsequent three-hour treatment given. This was paralleled by another case almost identical as to the size of the tumor, but no radium employed. The lumps in both instances were destroyed. We do not draw definite conclusions from this, but in general we feel that radium is probably supplanted by the x-ray used in the above described manner in this region. The burying of a needle or implantation of emanation necessitates a breach through lymphatics and blood vessels and is to be avoided.

Certain effects have been observed upon the lung structure which cannot be either definitely or accurately de-

scribed. We have noted very early parenchymatous infiltration in the lung after treating an overlying cancer of the breast, which has undergone regression subsequently. Whether this represents edema or lung destruction, is not known. Pleural exudate has been observed to follow treatments with symptoms of pleurisy of a mild type. The lung space seemed to decrease in other cases which have been associated with dyspnea and evidences of scar tissue formation, but later the difficulty in breathing is relieved to a great extent, which may in part be due to compensatory emphysema of the opposite lung. Still other cases show no demonstrable effect by x-ray examination. The subject is one, therefore, not capable of being accurately analyzed at this time, and it is recognized that certain of the above phenomena followed former methods of x-ray treatment.

In certain unfavorable cases this technique has unfortunately added rather than subtracted from the patient's suffering, but by way of defense, we submit that they were all postoperative, and, in our opinion, not properly selected as operable types.

The millennium in x-ray therapy is still postponed for a considerable number of cases of cancer of the breast in which there is extra mammary adenopathy at the time of surgical interference. No amount of treatment is adequate in controlling the persistent and widespread metastases in many of these sufferers, for, as is well known, the virulence of the disease is materially augmented by surgical operations, regardless of their extent.

The rapidity with which palpable and perceptible lesions in frankly inoperable types have disappeared is highly encouraging and justifies the hope that continued experience along these lines will mark a new era in medicine, for it must be admitted that the present one dates back at least 2,000 years when radical removal of the female breast for malignancy was first advocated and practiced. Even the temporary removal of demonstrable lesions in inoperable mammary cancer by a method comparatively free from hazard, pain or prolonged period of invalidism, is assuredly not only an innovation, but should command general, serious and friendly consideration.

It is extremely doubtful if either pre-operative or postoperative therapy has accomplished more than a postponement of a fatal issue in cases which prevented metastases into neighboring lymph nodes at the time of operation. It is highly problematical that pre-operative x-ray therapy has accomplished anything and it is the height of folly to expect more

in the future from a fairly thoroughly applied measure than has been experienced in the past.

Our experience leads us to the inevitable conclusion that, as a general rule, a woman afflicted with cancer of the breast, in which there is a tumor with extra mammary adenopathy, may expect better results from x-ray therapy administered as heretofore described than from any other form of treatment, and while we acknowledge the vast experience of others, we hold that this is true.

By way of retrospection the only argument in favor of the fractional dose method of x-ray therapy, aside from a material one which doubtless has appealed, is that in some mysterious way the resistance of body cells is supposed to be stimulated to a point whereby a cancerous growth is destroyed.

If this were the case, it would be not only advisable, but reasonable to treat superficial lesions by the fractional method. On the contrary, it is our belief, based upon the long experience of one of us (Groover), that prolonged fractional dosage has the effect of possibly increasing the resistance of cancer cells to the x-ray in certain instances. However this may be, the massive dose method of treating superficial lesions whereby the growth is wholly destroyed in one or two treatments seems to us to be a vastly superior technique and we can see no reason why deep seated cancer should now constitute an exception.

The current issue of the collected papers from the Mayo Clinic contains a description of their technique in the x-ray treatment of cancer of the cervix in conjunction with radium used locally. The subject is brought to your attention for the purpose of analyzing procedures in deep x-ray therapy in common practice.

Quoting from their article, "four to six areas over the lower abdomen are treated for four to five minutes each, with 9-inch gap, 9-inch distance, 5 ma., 4 mm. Al, and same areas posterior. Treatments every three weeks." Now this technique is employed for the purpose of destroying cancer cells some distance from the surface. The most that can be said or claimed for the system is that it represents the fractional method of attempting cancer destruction, but when we consider that a super-entire dosage it is expecting too much to hope that deep seated lesions will do more than thrive as a result of it, and the absolute accuracy of cross-fire is admitted for argument's sake.

It is our practice to treat superficial inch distance, 8-inch gap, half of cancer for ninety ma. minutes at 8-

the treatment with but 1 mm. of Al, and we have given 100 ma. minutes with the above factors without filter and without accomplishing anything more than complete destruction of the part treated.

We hold that it would not be bad practice to administer 150 ma. minutes, 9-inch gap, 9-inch distance, with 4 mm. of Al to a superficial cancer, and this is a multiple of the maximum number of doses given over the anterior abdomen to destroy cancer cells on a level with broad ligaments, as set forth in the article above mentioned.

The x-ray treatment of cancer will not be successful until, as we have

pointed out before, "the amount of x-ray delivered will stop just short of accomplishing more harm than good," and, in our opinion, the fractional dose method in deep x-ray therapy is doomed just as the fractional dosage of superficial malignant lesions has passed into history.

The question naturally arises if anything is being gained by increasing filtration up to $\frac{1}{2}$ mm. of copper without raising the voltage above the equivalent of a 9-inch gap between blunt points. The author is certain that the maximum skin dose with 6 mm. of aluminum, 5 ma., 9-inch gap, and 12-inch distance can be secured in forty minutes. It is also certain that this dose may be safely repeated to an

area if a four or five days interval between treatments is allowed. It may be worth while to record the fact that the above technique applied for one hour will result in a very intense reaction, which is characterized by vesiculation and loss of skin, and that by dividing the dose, allowing some days to pass, it may be repeated with resulting skin reaction of little or no consequence.

Whether the results secured by using the above factors with a 6 mm. Al filter, giving forty minutes with an interval of a few days before repeating, is approximated by using one-half mm. Cu filter and three hours time, cannot be stated from any practical experience we have had.



The Planning and Equipment of a Modern X-Ray Laboratory*

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INDUSTRIAL concerns have long recognized the value of efficiency engineering whereby their manufacturing processes are conducted with the minimum amount of waste and lost motion. Proper designing of his offices will accomplish the same purpose for the roentgenologist and save much physical effort and mental strain. The laboratory should be considered as a manufacturing plant in which the patient as the raw material is routed through at a maximum speed and a minimum inconvenience. Congestion of any part of the plant should be avoided, and this can usually be accomplished by a little care in making appointments. The average patient does not come to a doctor for pleasure and is very glad to get away as soon as possible. A large amount of work can be turned out in a short time and intervals of leisure obtained for rest and relaxation.

X-ray laboratories fall into two classes, institutional and private. The one is in a hospital or research institution while the other is a part or whole of a physician's office. There is no essential difference between the two as the mechanical equipment is the same in both. The private laboratory has usually a more elaborate arrangement of rooms as its clientele is composed of outpatients.

An x-ray laboratory may consist of one room with a dark room in the corner or the whole floor of an office building. Equally good work can be done in either, the only difference being in the quantity. Two sizes only will be of interest to the great majority of roentgenologists. One is a city laboratory with a flourishing business manned by the physician and one or more assistants. The other might be called a "one man laboratory" after the automobile top which, theoretically, can be handled by one individual.

The larger one should cover at least one thousand square feet of floor space and if possible should be in a new building, as a remodeled job is very expensive. The rooms should be so arranged that there is a natural division between the public and private portions. Furniture, rugs, hangings and decorations should be of good quality and taste, but subdued rather than ornate. An x-ray laboratory is a work

shop, not a drawing room, and its furnishings should be with this in view.

The public portion is for the reception of patients, physicians, and business callers. It should be located in the part of the suite nearest the front of the building and should comprise a reception room, display room, and consultation room.

In the display room are the negative illuminators, stereoscope and record files. A negative file should also be provided large enough to contain a year's work. The clerk's desk can be supervise the reception room and telephonically located here, as she can phones, and still be in the same room where the bulk of the record work is done.

A consultation room or private office for the owner is very desirable. There he can see business callers, transact his personal affairs, do his reading, and what is of great importance to many, have a place to smoke.

With these rooms located as described the public part of the suite is by itself. Physicians can come in and look at negatives and lose no time. Business callers can be seen and friends met without any interference with the privacy of patients being examined.

The private or work rooms fall into two classes, those in which patients are examined and the accessory space such as dark rooms and dressing rooms.

The heart of the plant is the machine room. This contains the transformer, Coolidge transformer, and time switch circuit breaker. It may be located in the basement or in a small room on the same floor. The switch board, time switch, and Coolidge control are centrally located with proper lead protection for the operator. A main switch which will cut off the current from every piece of apparatus is a necessity.

Emergency high tension lines can be constructed from clothes line, broom stick and bell wire, but a modern laboratory should have the best aerial system that can be obtained. It is safe, convenient, insures accurate technique and gives a finished appearance to the equipment. With it one transformer can serve as many rooms as desired by duplication of high tension switches but all these rooms should be within the vision of the operator to avoid accident.

In order to avoid congestion there should be at least two rooms supplied by the transformer. One may be used for general radiographic work and the

other for treatment. If there is much dental work a dental unit and chair will be a great time saver. This unit should be as near as possible to the reception room. If the radiographic room is large enough it may contain the fluoroscopes but a separate room is desirable if space permits. To those with surgical training the fluoroscopic reduction of fractures and removal of foreign bodies offers a very promising field for development. As this work usually requires an anesthetic a separate room is an absolute necessity. These rooms should communicate with each other and also open into a corridor so that patients may be introduced into any one at will.

The equipment depends upon the doctor's purse, the quantity and kind of work done, and the energy of the salesman. One transformer will serve the treatment and radiographic rooms and also the fluoroscopes if a remote control switch is used. If much fluoroscopic work is done a fluoroscopic unit will be found useful and, by proper arrangement of high tension switches, can be used for radiographic work in case of breakdown.

The radiographic room contains a stereoscopic tube stand and stereoscopic plate changer for chest and abdominal work. If there is a separate fluoroscopic room a plain wood table on castors answers the purpose admirably. It is light and easily pushed around and eliminates much of the danger of injury to the patient from a ground. It should be low enough for an injured patient to get on easily without being lifted. Combination outfits economize space but are expensive and not so flexible. For wrist and elbow work a light stand on castors about eighteen inches square and thirty inches high is very useful. The Buckey diaphragm is one of the essentials. Its bulk and weight renders its routine use awkward but tables are now being advertised which will render it always quickly available. A cupboard or closet should be provided for space tubes, cones sand bags, etc. For those who use plates, twelve gauge sheet steel cut to the proper size and nickel plated will be found useful to prevent breakage when placed under patients.

The treatment room must be well lighted and ventilated. The equipment consists of a comfortable couch and tube stand. The tube should be enclosed with suitable protection and equipped with an exhaust fan for cooling. A cupboard should be provided

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

containing filters, sheet lead, lead foil, rubber cloth etc.

The fluoroscopic room opens into the radiographic room and contains both vertical and horizontal instruments. A combination outfit may be used, but it is very expensive and takes as much room as two separate machines. If the transformer is used for fluoroscopic work the rheostat should be in the circuit to prevent accident in case of a ground. A three point foot switch is connected to different rheostat buttons, giving a choice of voltage without changing the settings. Both a white and blue light should be in the ceiling, the white light switch at the door and the blue light attached to the foot switch.

Dressing rooms are a necessity, especially for women patients, and obviate tying up the workrooms. These rooms need not be larger than four feet square and contain a chair, mirror and coat hooks. They may be more elaborate with a mahogany dressing table and chair, lamps, powder, etc, but so much magnificence is unnecessary.

Ample storage space should be provided to contain stationery, linen, tubes, eye localizer and all the miscellaneous odds and ends that are needed. A great deal of effort can be saved if there is a definite place for each article.

The dark room should have more thought given to its planning than any other part of the suite. It must be close to the picture rooms, have a window for ventilation, be easily and quickly made light tight, and as compact as possible. Any portion of it should be reached by two or three steps and yet there should be room for two people to work together. This can easily be accomplished in a space seven by ten feet exclusive of the entrance. The entrance may be a maze, double swinging doors or double sliding doors. The latter are the most economical of space, but usually must be installed when the building is constructed. The window should be four feet from the floor and furnished with wooden shutters. These may either be hinged to the casing or slide in grooves like the sashes. The latter arrangement gives an absolutely light tight window, easy

to open for ventilation and does not take up any space.

The equipment consists of a sink, tank, shelving and miscellaneous articles such as developing racks, trays, glassware, etc. The sink should be at least 20x30 inches, with solid back, and hot and cold water. Over it is an illuminator with a 14x17-inch opening for viewing wet negatives.

With the almost universal use of films the large Bowen tank is a necessity, as the film hangers take up a great deal of space. There should be a permanent cold water supply in the wash compartment with valve. On the wall in the middle of the tank should be a combination hot and cold water fixture to which a hose is permanently attached hanging in the spillway. On the same side of the room is a shelf 24 inches wide, level with the tank. This will hold the plate drying racks and be very useful for making prints and mixing solutions.

On the other side is a 24-30-inch shelf 40 inches high and as long as possible. All the loading and unloading is done here safe from any danger of contamination from solutions. The space under the shelves is utilized for the storage of containers for mixing developer and hypo, and plate and film storage. The photographic material should be in a lead covered cabinet to protect from fogging. Overhead on both sides of the rooms are two shelves 20 inches wide and 24 inches apart, the bottom one 72 inches from the floor. The space between is divided by vertical partitions into pigeon holes from eight to ten inches wide. In these are stored envelopes, plate developing racks, printing frames, trays, etc.

A very important thing is a place to dry plates and films. Plates may be conveniently dried in racks without taking up much space, but films present a different problem. The simplest way is to stretch a cord or wire across the room, but this is very messy on account of the drip. A space 16x26 inches in one corner will accommodate 24 developing racks. Two thin boards with notches one inch apart on their upper edges are spaced 14½ inches apart parallel to each other. The racks are

hung in these notches and a large tray put under them to catch the drippings. This tray will cause no extra work, as the water will evaporate. A fan may be attached a few feet above, which will insure quick drying.

The most scrupulous order and cleanliness is necessary in the dark room, although the reverse is usually the case.

The small laboratory should be as compact and as inexpensive to equip and maintain as possible. It should contain a reception room, radiographic and dark room, and if possible a combined consultation and display room.

If treatment work is to be done a large machine is necessary. It can be placed in one corner with a lead screen for protection, or, if there is available space, in a hallway or closet. If treatment is not contemplated a fluoroscopic unit with sufficient capacity to supply a thirty milliamper radiador tube may be substituted. The transformer of this unit is hung on the wall and much space, as well as first cost, is conserved. A high tension switch directs the current to the vertical fluoroscope or tube stand. A fluoroscopic table may be used, but will materially increase the investment. A stereoscopic plate changer should be provided either as part of the table or a separate instrument. A combination table and tube stand will economize space, but is expensive and not so flexible.

A space six by eight feet will amply accommodate the dark room. A wide shelf on one side and small tank and sink on the other with shelving as described above will give a very handy and compact arrangement.

If possible there should be another room for the physician's desk, records and files. The stereoscope may be placed here and will also serve for an illuminating box.

The ideas stated above represent general principles only. No one plan can be adopted as best for individual tastes, and architectural problems exert a modifying influence. If, however, the thought of economizing time and effort has been developed the purpose of the paper has been achieved.



ULTRA VIOLET RADIATION

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WHEN an electric current is impressed, uni-directionally, through the vapor of mercury enclosed in an exhausted quartz tube, there occurs a series of progressive changes that reach a stable equilibrium in about fifteen minutes. This equilibrium is characterized by the production of an intense illumination offering a relatively large proportion of ultra violet energy; a proportion greater in quality and quantity than that issuing from any other known source. Jeune, in his "Lampes a Vapeurs de Mercure," gives a comparison of the various sources of ultra violet energy as follows:

Source	Infra-red	Light	Ultra-Violet
1—Mercury Vapor	52%	20%	28%
2—Sunlight	80	13	7
3—Arc Lamps (such as carbon) . .	85	10	5
4—Incandescent Lamps	93	6	1

It is not enough to know that the mercury vapor arc is the richest available source of ultra violet energy. It should also be recognized that the quality of the spectrum derived from the quartz tube is vastly superior to that derived from any other agent. So that it is fitting to say that the quartz mercury vapor arc, in its modern form, represents a most efficient instrument for use in connection with clinical accomplishment.

Essentially, there are two types of mercury vapor tubes. One type consists of a vacuum arc in a fused quartz chamber. In this the discharge takes place between the anode and the cathode electrodes, both electrodes being liquid mercury. Another type, and a more modern one presenting certain important features over the older type, consists of metal (tungsten) lead-in-wire sealed directly to the quartz burner. Within the burner the cathode is metallic mercury, and the anode is a flat coil of tungsten wire.

ALL MERCURY ELECTRODE BURNERS

In the commercial development of the quartz mercury arc lamp the pioneer work is due to the Heraeus firm in Germany; and since tubes may be found on the American market, which are patterned after the principles first introduced by Heraeus, it is important that a complete understanding of this type of burner be had. ⁽¹⁾

It consists of a quartz tube connected at the ends to the two mercury-filled reservoirs. One of these reservoirs serves as the anode and the other as the

cathode. The tube is shaped differently near the reservoir. Toward the anode reservoir the arc tube is in the form of a sloping roof; whereas near the cathode reservoir the tube takes the form of a narrow, thick-walled, contraction. Each reservoir has attached to it a small quartz tube, which carries a metallic conductor through which the current is impressed. The tube is exhausted to a fair vacuum.

Says Weintraub:

"The 'ground joints' are attached to the reservoirs. It is not possible to seal metallic conductors

exposed to any considerable temperature rise. This limitation has the disadvantage of reducing the number of possible designs of the lamp."

As compared to the arc tube, the mercury reservoirs in the Heraeus type of burner are a very large size. This is necessary, as can be surmised by study of the volt-ampere current of quartz mercury arc lamp, shown by the curves on Fig. 1.

These curves show that when a certain current is reached the voltage rises very steeply. For the reasons of light efficiency, the quartz lamps operate on that part of the volt-ampere curve which is straightest; in other words, the quartz lamp under conditions of operation is a constant current device, so that no matter what voltage is impressed, or how much resistance is in series, current above a certain maximum value can not be forced through the tube. It is known that the constant current value depends primarily on the size of the mercury reservoirs by reason of the rate at which heat can be dissipated from their surfaces. For example, the curves obtained in Fig. 1 were derived by varying the size of the electrode reservoirs. In order to impress a current of even three and one-half amperes, the size of the reservoir has to be extremely large, so large as to interfere with practical utility; and therefore the heat dissipation must be augmented by an auxiliary means such as the attachment of metallic wings to the reservoir. Thus, in the Heraeus type of burner the heat dissipation control is a complicated one that involves the size of the reservoir, the number of metallic wings attached and the arrangement (distance apart) of the metallic wings.

More heat is generated at the anode than at the cathode; and unless certain precautions are observed the anode mercury would distill over into the cathode. While this could be prevented by increasing the heat dissipation of the anode as compared to the heat dissipation of the cathode, this method would not yield a satisfactory control. The commercial expedient still used in this type of burner is to shape the tubes differently near each electrode. For instance, the cathode reservoir is connected to the light given tube by a contracted part, in such way that, during the luminescence of the arc, the mercury remains in this contracted space. This introduces a narrow column of mercury

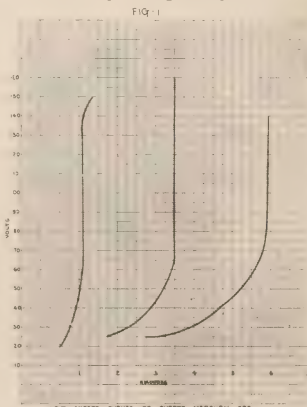


Fig. 1.

between the reservoir and the arc which conducts the heat away with difficulty, and tends to increase the rate of vaporization of mercury at the cathode as compared to that of the anode.

TUNGSTEN MERCURY ELECTRODE BURNER

This development is a result of the work carried out in the Lynn Research Laboratory of the General Electric Company. Weintraub writes:

"The first problem attacked and solved was that of introducing current into exhausted quartz vessels, not by means of ground joints but by means of metallic wires sealed-in in a vacuum tight manner.

"In principle, the method used is that of interposing between the quartz and a suitable metallic wire different glasses of variable coefficients of expansion. The coefficient of expansion is in the neighborhood of 0.5×10^{-6} ; the coefficient of expansion of platinum, which is the metal used in glass seals, is in the neighborhood of 9.0×10^{-6} . The glass on the market with the lowest coefficient of expansion has an expansion of about 3.5×10^{-6} .

"To make possible the connection of this low expansion glass with lead glass, six intermediate glasses were necessary, these glasses being obtained from the glass factories.

"To connect quartz to the low expansion glass, glasses were needed with intermediate coefficients of expansion. After considerable work, glasses filling the requirements were prepared and it was found that four such 'intermediates' were necessary to produce a reliable joint. In all, ten different glasses were therefore necessary to enable one to seal in platinum wire. This large number of intermediates made the method expensive, and it was also found that the reliability of the joints between the low expansion glass and lead glass was not sufficient for shop use.

"Fortunately, we soon made the other and equally important discovery that tungsten wire could be sealed into the low expansion glass in a vacuum tight manner. The number of intermediate glasses was, therefore, reduced to only four, and tests on a large number of these seals have shown them to be reliable. They stand higher temperatures than any other vacuum seal, and, due to the higher electrical conductivity of tungsten, can carry more current

for a given cross section. The tungsten leading-in wire, in combination with low expansion or heat-resisting glass, is also being used in a new type of rectifier and bids fair to become of importance in the field of gas-filled Mazda lamps. These 'graded' seals are not only cheaper than the ground joints, but they permit certain designs of tube that would be impossible with the ground joints.

"The use of these graded seals, capable of withstanding relatively high temperatures, suggested at once the replacement of the mercury anode used in the Heraeus quartz lamp by a solid anode.

"The solid material to be used as an anode in the quartz mercury arc lamp must have a very high melting point and a very low vapor tension. It must have a high melting point in order to withstand not only the normal temperature developed at the anode by the lamp current, but also the much higher temperature produced by the initial current, which is many times larger than the equilibrium current. The material must have a low vapor tension, because it would otherwise slowly volatilize and blacken the tube, especially in the neighborhood of the anode, a blackening which is the more serious as the light-giving section of the tube is short. Materials fulfilling these requirements were not known until recently, and among those available now, tungsten and tantalum are the best.

"The use of a solid anode has numerous advantages. Mercury vapor is now evolved only at one electrode, that is, the cathode, so that the vapor pressure for the same current and the same size mercury reservoir is greatly reduced. Of course, balancing of the vaporization of mercury at the two electrodes is no more needed since no mercury is evolved at the anode; therefore the peculiar narrow space near the cathode can be dispensed with, thereby still further reducing the vapor pressure. This means that for the same current a much smaller mercury reservoir can be used and no wings are necessary.

"The elimination of the mercury anode reservoir, the reduction of the heavy quartz tubes used in the ground joints has reduced the amount of quartz and the amount of labor necessary to shape the tube to from one-third to one-half that of the corres-

ponding device of the Heraeus type.

"The peculiar difficulty of forcing large currents through the quartz mercury arc lamps was referred to above. This difficulty is greatly reduced in the case of the General Electric type of lamp. The volt-ampere curve has still the same characteristic, in that the volts rise very rapidly when a certain current is reached, but, with a reasonably sized mercury cathode reservoir, currents as high as six or seven amperes can be easily forced into the arc, as against the three and one-half or four amperes of the Heraeus type. Still larger currents can be obtained if wings or a small condensing chamber are provided."

TUBE EFFICIENCY

Quartz limits the permeability to ultra violet, depending upon:

1. Thickness. 2. Clarity.

According to the source of quartz, considerable differences exists in the ultra violet transmission of various specimens. For the crystalline variety, more ultra violet is absorbed when the path is parallel to the axis of the crystal than when the path is perpendicular. Pfeuffer, quoted by Lyman, gives the following figures for quartz one centimeter thick:

Wave length	2220	2140	2030	1860
Per cent absorbed . . .	5.8	8	16.4	32.8

Fused quartz is ordinarily less transparent than crystal quartz; though it has been found that this effect is due to an added impurity, for there are now certain varieties of fused quartz that are quite transparent to light of much shorter wave lengths than 1850.

It may be said that the present modern form of ultra violet generating tube furnishes a spectrum that holds an ultra violet component extending as far as 1850 Angstrom units, where the limit of quartz penetration is reached.

It is generally known, and should be expected that from the standpoint of physical production the ultra violet intensity derived from mercury arc of whatever type is equal only when the energy input is identical. Coblenz says that the intensity of ultra violet emission varies practically as the square of the energy consumed in the burner. That is, if the energy input is doubled the light intensity is increased four times. This is shown in his Fig. 2.

Bohle, in his Electric Photometry and Illumination, infers that the relation between the volts and the temperature is, up to a certain point, a parallel one. In some experiments with air cooled ultra violet equipment such as is used

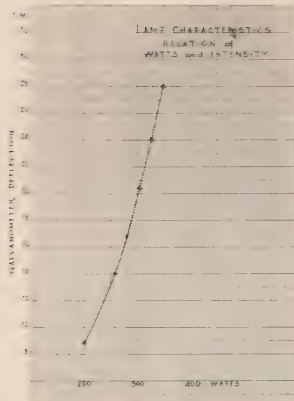


Fig. 2.

in the clinic, it has been possible to show that the temperature rises proportionately with the voltage up to a certain point. See Table I.

The effect of increasing temperature

TABLE I.
Temperature*—Voltage—Ampere Characteristics.
A. C. Mercury Vapor Air Cooled Lamp (Victor), with rectifier control.
SELECTIVE INTENSITY SWITCH SETTING

Time (Minutes)	Low			Medium			High		
	Amps.	Volts	Temp.	Amps.	Volts	Temp.	Amps.	Volts	Temp.
12.0	3.25	45	28.5	3.25	60	69	3.25	70	75
Start	7.5	5	22	9	10	20	9.75	12	19
0.5	7.5	12	22.5	9	12	21	9.5	13	19
1.0	7.25	13	23	8.75	14	22	9.5	14	21
2.0	7.24	15	24	8.5	15	24	9.0	20	23
2.5	7.0	15	27	7.5	25	26	8.5	24	27
3.0	6.5	20	28.5	6.5	30	33	7.0	34	38
3.5	6.0	25	32	6.0	40	40	6.5	40	44
4.0	5.5	25	36	5.0	45	43	5.75	48	50
4.5	5.25	28	38	5.0	48	47	4.75	50	55
5.0	5.0	32	41	4.0	52	51	4.0	58	58
5.5	4.5	34	44	4.0	55	54	4.0	60	61
6.0	4.1	36	48	3.75	55	57	3.5	65	64
6.5	4.0	39	50.5	3.5	58	59	3.25	67	66
7.0	3.8	40	51.5	3.5	59	61	3.25	68	68
7.5	3.5	41	53.5	3.5	55	63	3.25	70	69
8.0	3.5	42	56	3.25	60	64	3.0	70	71
8.5	3.5	43	57	3.25	60	65	3.0	70	72
9.0	3.5	44	59	3.25	60	67	3.0	70	72
9.5	3.5	45	60	3.25	60	68	3.0	70	72
10.0	3.5	45	61	3.25	60	68	3.0	70	73
10.5	3.5	45	61.5	3.25	60	68	3.0	70	74
11.0	3.5	45	61.5	3.25	60	69	3.0	70	74
11.5	3.5	45	62	3.25	60	69	3.0	70	74
12.0	3.5	45	62	3.25	60	69	3.0	70	74

*—Temperature determined always at one point, casing closed. These figures are valuable only for comparative purposes, showing the relation of temperature.

is to amplify the relative intensity of the shorter wave lengths in accordance with the displacement law of Wien (in temperature radiation, the higher the temperature the shorter the wave lengths emitted). One of the effects of the ability to withstand high temperature is the insurance of a some-

what greater intensity of short wave lengths. This can be appreciated by reference to the subjoined series of spectrograms made with an air cooled mercury vapor lamp with a tungsten mercury electrode burner shown in Fig. 3.

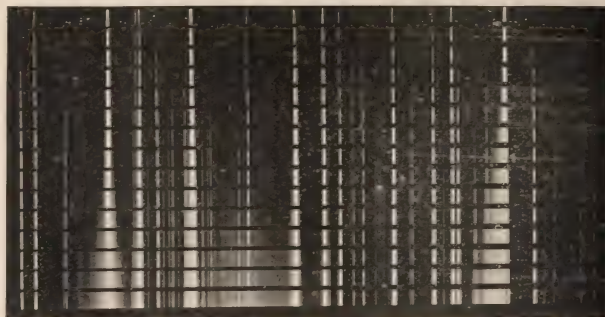


Fig. 3.—Each row of spectral bands represents the spectrograms of the mercury arc air cooled lamp. The top row is 35 volts. Each successive row increases by 5 volts, so that the bottom band is at 105 volts. Each individual exposure was forty-five seconds. The distance from the spectrograph slit is constant throughout. Othonon plates were used. Prepared by the courtesy of Mr. L. J. Buttolph, Cooper Hewitt Electric Co., Hoboken N. J.

EFFECT OF WATER COOLING

R. W. Wood has pointed out an interesting and important operating characteristic of the mercury vapor arc at high voltage, such as is incident to the operation of the air cooled lamp. The heat development tends to volatilize some of the unused mercury in the cathode reservoir, giving rise to a film of mercury vapor that envelopes the luminescent stream. One of the effects of this mantle of mercury vapor is to diminish, by absorption, the intensity of some of the short wave lengths.

When an adequate water cooling device is added to the tube the temperature drops and therefore the voltage consumption is minimized; and the water cooling serves to condense the volatile mercury vapor surrounding the incandescent arc. The effect of the water cooling is to strip the central stream of luminosity from the absorbing mantle of mercury vapor; and this insures a maximum emission, particularly of the region 2536. This difference in intensity of the 2536 line under conditions of air and water cooling is somewhat illustrated by the accompanying comparative spectrograms. (Fig. 4.)

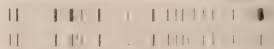


Fig. 4. The upper spectrogram shows the water cooled spectrum giving a great intensity of the 2536 line (heavy haloed line at right); compare with the much less intensity in the spectrum below, obtained from the same lamp improperly operated at very high voltage.

Since laboratory experiments show maximum bactericidal effect to be resident particularly in the region of 2536, it is obvious that the maximum bactericidal quality of the water cooled equipment is obtained under operating conditions that yield highest intensity of this wave length. This is obtained usually at the level of 50 volts and efficient water cooling by free water circulation.

ULTRA VIOLET SPECTRUM

The complete quartz mercury arc frequency spectrum is reproduced; in this the various diagrammatic parts are accurately produced, giving above, the wave lengths in Angstrom units; and below, the frequency of oscillations per second. ⁽²⁾ (See Figs. 5 and 6.)

It is convenient to adopt the classification arbitrarily suggested by Luckiesh, in which that portion of the ultra violet spectrum extending from the visible violet to 3,000 Angstrom units is designated as near ultra violet; and the region extending from 3,000 to the limit of quartz transparency is designated far ultra violet.

From the general characteristics of lamp operation, as discussed above, it will be observed that the air cooled equipment furnishes a markedly intense near ultra violet spectrum; and the water cooled, in comparison, dominantly a far ultra violet spectrum characterized by a brilliant intensity of the 2536 region.

It has been known that the rays more actively bactericidal are those which have wave lengths under 3,000 Angstrom units; and the rays that produce marked erythema are longer than 3,000 Angstrom units.

By selective filtration the important ultra violet bands arranged in the order in which they produce skin reddening have been found to be as follows:

Wave Length	Minutes	Wave Length	Minutes
4000	over 30	3022	10
3907	over 30	2967	3
3821	over 30	2925	5
3752	30	2894	9
3663	27	2804	15
3650	26	2753	25
3644	26	2700	35
3391	15	2654	60
3342	14	2576	60
3126	12	2563	70

It is noticed that over a given region the biological intensity of the rays diminishes rapidly with diminishing wave lengths. By similar tests the bactericidal effect of the ultra violet energy is shown in the accompanying diagram:

Wave lengths destroying *N. Y. Health Department strain of typhoid bacilli* in homogeneous and counted suspension (saline) and time required.

Wave Length	Time	Wave Length	Time
4078	....	2804	4 min.
3907	....	2753	3 min.
3821	....	2700	3½ min.
3752	....	2654	2½ min.
3663	18 min.	2576	2 min.
3650	....	2536	40 seconds
3544	....	2482	45 seconds
3391	....	2446	40 seconds
3342	14 min.	2412	....
3126	9 min.	2378	35 seconds
3022	6 min.	....	....
2967	6 min.	2302	35 seconds
2925	5½ min.	2253	40 seconds
2894	5 min.	2225	35 seconds

From these two illustrations it is proper to conclude that, for purposes of biophysical usage, we may ascribe to near ultra violet an action which is dominantly biological as compared to the dominantly bactericidal quality of the far ultra violet.

Ritter, Herschel and Becquerel, in 1872 advocated a theory that the short wave lengths, of a great refrangibility, effect a reducing action, as opposed to the oxidizing action of the longer waves of greater refrangibility. This theory is also maintained by Draper. It is a fundamental moment for the interpretation of photochemical phenomena, though it requires very special handling in given cases as applied to some of the oxidations and reductions involved in the vital activities of the human body. Sufficient study has been directed to the difference between the effects of these rays to warrant the expression at this time that, in general, the near ultra violet (long wave lengths) is oxidizing and the far ultra violet (short wave lengths) reducing, as applied to the chemical energetics of the human organism.

Coincident with the effect of oxidation and reduction is the metabolic change induced by the ultra violet energy. Considering metabolism to be an equilibrium between the building up and the breaking down of tissue processes (anabolism and katabolism) it is possible to divide the action of ultra violet energy as exerting (1) for the near ultra violet, a synergistic effect; and (2) for the far ultra violet, a retarding effect. Rideal and Taylor in "Catalysis in Theory and Practice," point out that reactions exposed to radiant energy may either be accelerated or retarded; a chemical analogy from the inorganic laboratory of the reactions that proceed under the influence of ultra violet energy in the physiological laboratory.

From the discussion of the characteristics of the air cooled lamp and

water cooled lamp, and upon a consideration of physical and chemical manifestation exhibited by each, it is possible to divide ultra violet energy for biophysical purposes as follows:

ULTRA VIOLET Energy

(Mercury Arc) AIR COOLED LAMP

1. Near ultra violet intensity.
2. Biologic (dominantly).
3. Chemically oxidizing.
4. Relatively penetrating.
5. Metabolic synergist.

WATER COOLED LAMP

1. Far ultra violet intensity.
2. Bactericidal (dominantly).
3. Chemically reducing.
4. Relatively superficial.
5. Metabolic depressor.

It is understood, of course, that the subdivision is one based on efficient usage. There may arise certain indications when the application of the ultra violet would be easier through the use of the water cooled lamp than through the air cooled lamp, despite the fact that the pristine pathology is such as to require the biologic rays. In such cases, the results obtained may be gratifying, though obviously less certain than if the proper choice in lamps could be made.

OPERATING CONSTANTS

A number of factors are involved in the operating characteristics of the air and water cooled lamps. These are:

1. Temperature.
2. Amperage.
3. Voltage.

There is an equilibrium between the energy input and the heat output of the mercury arc; and unless this equilibrium is reached and maintained, the efficiency of lamp operation is impaired.

In the modern form of tungsten electrode tube, the rating is:

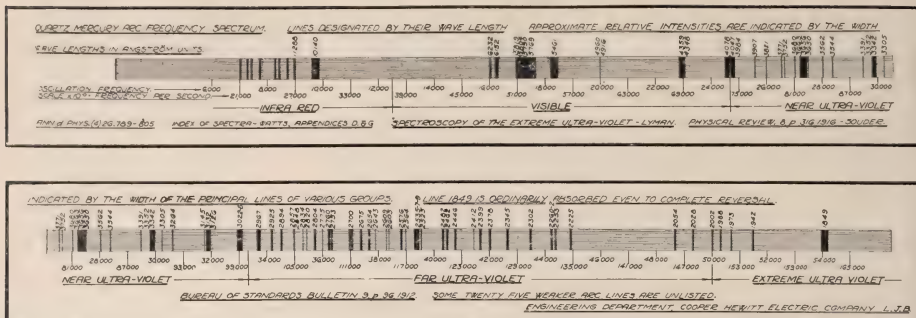
Air cooled tubes. 325 Watts⁽³⁾

Water cooled tubes. 250 Watts

The starting conditions, while interesting, need not be considered here, because they contribute to a practical working knowledge of the tube. When operating at equilibrium, the amperage assumes a value largely dependent upon the efficiency of heat dissipation, expressed generally as cooling. As the temperature rises, the amperes fall; and, conversely, as the temperature falls, the amperes rise. So that the relation between the temperature and current (amperes) is a reciprocal one, tending to constancy. Observe that the ampere characteristic is mainly a function of temperature regulation and is quite independent of line conditions.

With the voltage, the situation is different. It depends upon—

1. Line voltage.



Figs. 5 and 6.

2. Voltage drop due to interposed resistance.
3. Amperage.

Most usually, the line voltage is in the neighborhood of 110, which is reduced by interposing a ballast resistance. And after interposing the ballast resistance, the temperature control, by its effect on the ampere control, is the next factor influencing the voltage equilibrium.

Speaking now from the viewpoint of clinical efficiency, we may summarize the conditions, and their reasons, that the air and water cooled lamps best operate under:

	Air Cooled	Water Cooled
Amperes . . .	3.25 to 4.50	4.5 to 6.5
Volts	90 to 70	60 to 40
Regulation	Resistance	Resistance

Water Cooling

Operated under these conditions, there is insured a maximum useful life for the tube; a maximum efficiency of spectral quality for clinical purposes; a greater degree of manipulative satisfaction in eliminating interfering influences such as arise when the tubes are operated on other than their characteristic equilibrium.

CLINICAL INEFFECTIVENESS OF TUBE DEPRECIATION

It is a current opinion that the intensity of quartz mercury vapor arc radiation, more especially the ultra violet component, issuing from quartz mercury vapor lamps, greatly decreases

with usage; a factor that challenges the life-efficiency of ultra violet tubes.

In the tungsten electrode tube the factors that enter into the deterioration of the emissive qualities may be grouped into two sets; first, the deposit of electrode products (vaporized tungsten) on the walls of the tube; and, secondly, divitification of the quartz wall.

Both of these are virtually functions of the temperature characteristic of the tube.

In the case of the water cooled tube, which should be operated at low-temperature-voltage characteristics, both the tungsten vaporization and the quartz divitification are always at a minimum; so that the intensity emission of the water cooled type of burner remains efficient for practically the entire period of tube existence.

Modern practice shows a growing tendency to adopt the clinical classification of air cooled and water cooled lamps, as, respectively, biologic and bactericidal energies; the air cooled lamp representing the near ultra violet intensity of long wave lengths, as compared to the short wave lengths for far ultra violet intensity of the water cooled lamp.

The quartz transmission of ultra violet is determined by the absence of enclosed or deposited impurities. Divitification and tungsten vapor deposit are, effectively, enclosed and deposited changes. It is well known that as a material becomes increasingly opaque to ultra violet energy, the opacity begins

first with the shorter wave lengths, and gradually extends to the longer wave lengths. For reasons that have elsewhere above been discussed, the extremely short wave lengths generated in the air cooled burner, are not completely transmitted. The transmission is hindered by a veil of mercury vapor which is formed around the luminescent arc as the result of the volatilization of part of the unused mercury in the cathode reservoir. Deposits of tungsten vapor on the interior of the tube surface are generally localized to the immediate radial vicinity of the tungsten anode, and in this limited localization the tungsten deposit, even if accumulated in liberal quantity, is effective only in obstructing the shorter wave lengths; so that the biologic intensity included in the wave lengths longer than 2,700 Angstrom units has not been found to be appreciably decreased or effectively impaired, clinically, during the life-course of the tube.

From the viewpoint of the clinician, the physical laboratory reports of the decrease in ultra violet radiation with usage of quartz mercury vapor lamps are beyond the practical standards set by commonly adopted medical uses; and it may be fairly said that, employed in the manner recommended as being more efficient, the intensity emission characteristics of the air cooled and water cooled burners remain virtually unimpaired, or are impaired so slightly as to make the tubes useful for practically their entire life.

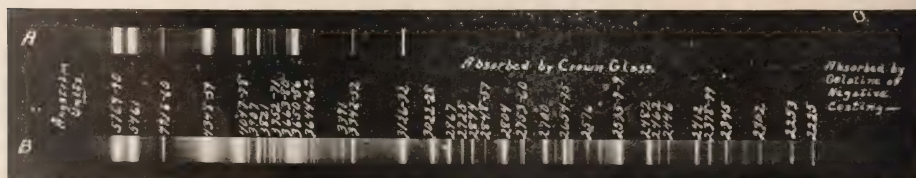


Fig. 7.

FOOTNOTES

1. The material for the discussion of the Heraeus type of burner is taken mainly from the article "The Quartz Mercury Lamp," by Dr. E. Weintraub. This appeared in the General

Electric Review for the year 1914, page 270.

2. This frequency spectrum, together with the prisim spectrum has been courteously loaned by Cooper Hewitt Electric Company, kindness of Dr. Mailey and Mr. Buttolph. I am

indebted to the same source also for the prismatic spectographs taken in various voltages and for a prismatic spectrogram showing the glass and quartz transmission.

3. A watt is the product of an ampere times a volt.



An Apparatus for the Purification of Radium Emanation

C. F. WHITTEMORE, M. S.

Denver, Colorado

AN apparatus for collecting and purifying radium emanation recently installed at the Rutherford Hospital, Rutherfordton, North Carolina embodies several new features of design which may be of interest to others who use radium. The general principle of the method employed for purification of the gas is the same as that used by Debeirne and others in their early research and later used by Duane in his apparatus at the Huntington Hospital in Boston. In designing the equipment described and illustrated in this publication, the writer has adopted the plan of mounting two complete units on a metal frame as in the Failla installation at the Memorial Hospital, New York City, but the design differs in many respects.

The manifest advantage of using the much more compact tubes of radium emanation instead of radium itself has been discussed so often it requires no further comment here, but it may be advisable to refer to the advantage of the Duane type of apparatus over other forms of equipment. This advantage lies chiefly in the fact that liquid air is not required. A great many milluries of the emanation may be purified and collected in extremely small tubes having a volume less than one cubic millimeter, and the apparatus may be used daily for long periods without replacement of parts.

A diagram of the glass parts shown in Fig. 1 is not a working drawing, but is intended simply to illustrate the essential features. The radium is placed in a slightly acid solution in a flask (1) which is surrounded by other protecting vessels and enclosed in a wall safe through which a glass tube (2) extends and connects with the first bulb (3) of the apparatus. The radium emanation is a gas which could readily be collected if it were not for the fact that the water of the solution is decomposed into hydrogen and oxygen by the radium rays. The emanation, which is extremely small in volume (1,000 milluries amounting to only approximately six-tenths of one cubic millimeter) is therefore mixed with relatively large volumes of hydrogen and oxygen. These gases accumulate in the flask (1) after all air has been pumped from the entire apparatus. Diffusion of the mixed gases through tube (2) into bulb (3) is effected when the mercury is lowered below the junction of the connecting tubes at (4). Owing to their pressure the gases begin to enter the bulb (3) before the mercury is completely

lowered. A by-pass (5) is therefore provided here to prevent the violent bumping which would occur if the gases were required to enter bulb (3) from directly below the large quantity of mercury. There is no appreciable disturbance when the gases bubble through the side tube or by-pass.

The radium emanation and extraneous gases are next forced through the mercury trap (6) into the purifying chambers (7), (8) and (9) by opening stopcock (10) and permitting air at atmospheric pressure to enter reservoir (11). The mercury consequently rises in bulb (13) until all the gases contained therein have been carried before it into the purification chambers. This pumping operation is repeated until practically all of the emanation has been drawn from the flask. Generally three operations suffice. The mercury is allowed to rise only a short distance above the capillary trap (6) and it automatically stops before entering the chambers which are placed well above barometric height. The glass tube (7) contains the usual oxidized copper wire in the form of a spiral around a quartz rod supported at each end to prevent the hot wire coming in contact with the glass walls. When heated to redness by means of an electric current varying from two to ten amperes the hydrogen and oxygen combine and the resulting water is absorbed by phosphorous pentoxide in tube (8). There is an excess of hydrogen above the amount required to form water by combination with the oxygen present, hence the necessity of a small amount of copper oxide which eliminates the remaining hydrogen. This excess of hydrogen is attributed to the formation of hydrogen peroxide whereby some of the oxygen is retained in the radium solution. The potassium hydroxide in tube (9) eliminates any carbon dioxide, leaving the small volume of radium emanation free from impurities, except helium, which is present in a volume slightly greater than that of the emanation itself. The total volume of the purified radium emanation and the helium is so very small, however, no further treatment to remove the helium is necessary.

The Lind type of coil in which a platinum wire carries the electric current to heat the copper-oxide has not been used in this apparatus because the writer's experience has shown that the simple oxidized copper coil is entirely satisfactory, lasting for more than a year, and in one instance, for fully fifteen months with collections as a rule

three times each week. Whenever replacements eventually become necessary it is a convenience to have but one glass tube connection as illustrated in Fig. 1. The coil is placed above the chemical chambers on a separate tube instead of in the direct line, which would require two connecting tubes with consequently greater difficulty in replacement. The coil shown herein may be readily detached by cutting the single connecting tube and the new part sealed on in one operation. Offsetting the coil from the main line in this manner does not impair the efficiency of the apparatus judging from the consistently high recoveries of purified emanation.

The removal of the emanation from the purification chambers is accomplished by bulbs (12 and 13) which constitute essentially another Toepler pump similar to the parts (3 and 11) employed in bringing the gases into the apparatus from the radium flask. During the purification process, the mercury has remained in bulb (12) and tube (14). It is now lowered by pumping the air from reservoir (13), opening stopcock (15) to permit the flow from bulb (12) to (13). The junction (16) of the connecting tubing is thereby unsealed and the purified emanation diffuses into (12). Air entering reservoir (13) through the three-way cock (17) forces the mercury to rise again in (12) and the emanation is carried past the cock (18) which is then closed. Mercury has been allowed to stand in the U-tube (19) in order to prevent the passage of the gas into the tube (20) and to direct it into the fine capillary tube (21) which is the final container. Air is then allowed to enter reservoir (22) the mercury flowing through open stopcock (23) to U-tube (19) and into the capillary (21), where the emanation is finally collected. A small gas flame is used to fuse this tube and remove that portion containing the emanation.

This part (19) of the apparatus has been placed as far as possible toward the side in order to make room for the long capillary tube, which extends across the machine. In this manner it has been possible to eliminate the undesirable extension of the capillary beyond the supporting frame of the apparatus. The capillary is supported by wire hooks suspended from a rod which is rigidly attached to the heavy metal frame. A mercury-sealed three-way stop-cock (24) facilitates the connection of either unit with the vacuum pump.

Metal tubing for the frame of the apparatus possesses several advantages over the customary angle-iron supports. Its superiority lies chiefly in its greater rigidity. In this installation all electric wires have been concealed within the hollow tubing, thereby eliminating the

usual unsightly separate conduits, or open-wiring. Wherever wires extend through the frame, as for example, near the copper coils and back of the switchboard, standard porcelain condulets are threaded directly into the tubing.

All electrical controls are assembled

on one switchboard within easy reach from either side of the apparatus. A small pilot lamp at the top of the switch panel is lighted while the current is passing through the coils and serves to remind the operator to switch off the current before leaving the laboratory.

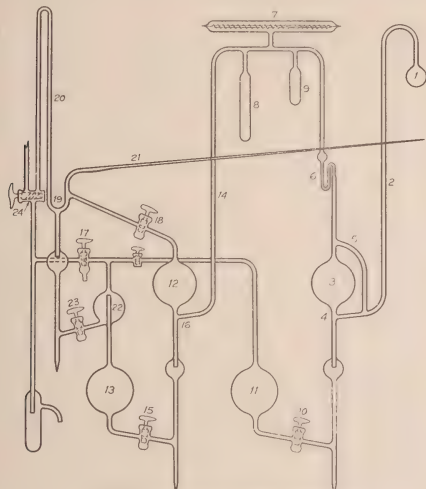


Fig. 1—Diagram of glass apparatus.

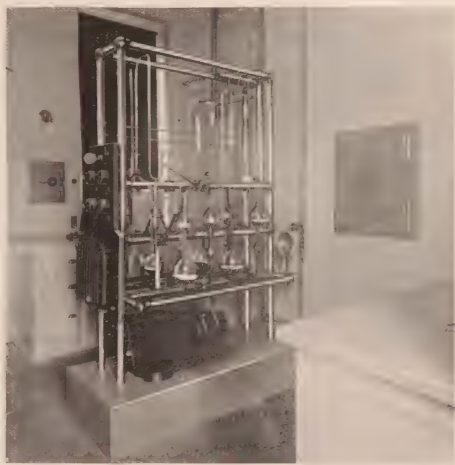


Fig. 3.—General view of radium emanation laboratory.

A "battery-charging" type of rheostat completes the switchboard equipment.

Another feature of this design is the method of supporting the mercury-sealed stop-cocks. In the opinion of the author most of the breakage of stop-cocks on apparatus mounted on metal frames has been due to insufficient support. Generally no provision whatsoever has been made to attach the stop-cocks to the frame. In this installation a metal plate is fastened to the frame, just back of each cock, which is then bound to the plate by metal bands on each side. Thick felt packing around the glass tubing between the bands and plate serves to hold the stop-cock very securely, yet without exerting any strain upon the connecting parts.

A two-stage oil-sealed rotary vacuum pump is used both for exhausting the air



Fig. 2—Complete apparatus showing glass parts, vacuum pumps, and electrical connections.

from the entire apparatus and for manipulating the mercury pumps. The rotary pump is operated by a one-half horse power electric motor mounted upon the same base as regularly furnished by the General Electric Company. The author has employed the same type of pump, in conjunction with a Langmuir mercury vapor condensation pump, in another installation for over three years, and found it most satisfactory for this service. The Langmuir pump is often a convenience for general laboratory purposes, but entirely unnecessary in connection with the radium emanation apparatus and has not been included in later installations.

A near view of the complete apparatus is shown in Figure 2 and a more comprehensive view of the entire radium laboratory at the Rutherford Hospital in Figure 3.

EDITORIAL

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ANNUAL MEETING

Hotel Statler, Detroit, Michigan

December 4, 5, 6, 7, 8, 1922

A Review of American Radiology

IT HAS BEEN a long and eventful journey from the ten-inch coil to the twenty-inch transformer, from the three-inch Crookes tube to the thirty-inch Coolidge tube. But that has been the price paid by American radiologists, many of whom are still living to bear witness concerning the pleasures and the pains encountered while traveling the rugged road of development which has characterized the growth of the science of radiology.

In this respect, the science of radiology is perhaps no different than any other science. Humankind is always prone to belittle the accomplishments of contemporary workers in the scientific field. However, as the passage of the years affords a new perspective, and the cumulative results of a given scientific achievement appear, skepticism is too frequently supplanted by credulity; and it often becomes necessary to provide impartial methods for viewing the attainments achieved in a particular branch of science, so that their relation to the whole scientific field involved may be correctly valued, and a reasonable estimate of their potential possibilities fixed.

That is why it seems wise at this juncture to review the enormous developments actually accomplished in the science of radiology in the last 27 years—which, by the way, are the first 27 years of its existence. Notwithstanding this apparent newness, there can hardly be any question that sufficient time has elapsed to furnish a substantial background against which to trace the trend of the science in its relation to the public health generally, and to all medical science specifically.

By cataloging the recognized achievements of some of the conspicuous characters contributing to the science, it ought to be possible to get a fairly definite and comprehensive picture both of the present utility of the science of radiology and its future possibilities.

Such a review will, of course, have to do very largely with the formative period of the science. That is the reason why it is so important to chart its course. Particularly is this so since the science of radiology is now emerging into a broader and more responsible sphere of activity. And the suggestion can hardly be otherwise than well taken, that in

the attainments of the outstanding men who have builded the science to its present degree of utility, will be found certain indications pointing the way to present and future effort.

Brief recital of the accomplishments of the men who are responsible for the present high state of radiology, will unquestionably warrant the conclusion that the science of radiology is the supreme composite conception of the biggest and best brains in all branches of medicine. This thought is not stated with any desire to pat the radiologist on the back, by implying that he is a specially endowed member of the medical profession. Rather, it is stated for the purpose of directing attention to an indisputable fact, a fact which, stated in a few words, means that the radiologist travels a dangerously precipitous path, for that it runs along the crest of all medical science and deals with both negative and positive formulas. In short, the radiologist is charged with the responsibility of providing certainty in diagnosis and precision in treatment; and the man or woman who approaches the science, either as a contemplating practitioner or as a user thereof for diagnostic and therapeutic purposes as an aid in his work, with the thought that it is but a highly specialized branch of photography, is bound to come to disaster as an individual and in results obtained.

Any man who will measure the achievements of the outstanding figures in radiology with a fair degree of conscience will recognize that whatever attainments have been gained, have been gained by sheer scientific effort, a superhuman devotion, and an incomparable faith in the value of radiant energy diagnostically and therapeutically applied.

EARLY MARTYRS

These columns have chronicled the demise of several men who have been martyrs to the cause of American radiology, men who have paid the supreme sacrifice that those of the younger professional generation might profit by their experience and "carry on" without the pain and suffering and death which they suffered. To mention the names of Dr. Eugene W. Caldwell, Dr. Walter Dodds, Dr. Heber Robarts and Dr. John Nesbit Scott, is to utter a prayer of thanksgiving that men of such sterling character were given to the great body of American physicians and radiologists—a prayer that those of us who assume to pick up their labors may profit by their experience and may prove worthy to be called followers in their footsteps.

All of these men were charter members of the American Roentgen Ray Society and did much to organize and lay proper foundation for what has developed into one of the great roentgen ray societies. Dr. Robarts, who but lately dropped his mantle on the shoulders of lesser radiologists as he ascended in a chariot of fire, was the founder of the American Journal of Roentgenology. The first meeting of the American Roentgen Ray Society was held in his office. He was elected its first president. It will be recalled that he was not only active in this society, but was also active in The Radiological Society of North America; and upon him and Dr. John Nesbit Scott the honorary degree was conferred by the latter in 1919.

To Dr. Walter Dodds is due the credit of organizing the x-ray department of Massachusetts General Hospital. The value of this institution in leading the radiologists of America to better things is immeasurable. To him is also due the honor of developing the so-called "Dodds Formula" which has relieved the suffering of many patients and has be-

come a household remedy for the treatment of x-ray dermatitis by American radiologists.

Dr. Dodds was one of the earliest pioneers in American radiology. His experiments had been carried on long enough that in 1896 he suffered his first operation for the relief of x-ray dermatitis. Following this, up to the time of his death in 1918, he submitted to fifty operations. In spite of his physical condition, he volunteered his services to his native country, England, very soon after that country entered the war. The sacrifice which he paid can best be appreciated by the knowledge that the exposure to x-rays incident to army service set on fire the old trouble and soon took his life in payment.

Dr. Caldwell might be called the "chief corner stone" of the profession of radiology in America. His education as an electrical engineer provided a knowledge possessed by few medical men. Dr. Caldwell used this knowledge to wonderful advantage in improving apparatus and devising new equipment. His valve tube, his stereoscopic fluoroscopic table and his early work on x-ray diagnosis of diseases of the nasal accessory sinuses, were original and valuable.

EARLY PIONEERS

Among the early pioneers in American radiology one naturally thinks of Dr. Francis Williams, who was the first to employ the x-ray for therapeutic and diagnostic purposes in America. He wrote the first American textbook on x-ray therapeutics. He still lives to breathe his beneficent inspiration into the younger generation of American radiologists. At the Boston meeting of the American Radium Society, held in 1921, Dr. Williams was present, and was made an honorary member of that organization in recognition of his contributions to the science of radiology. He was the first American physician to employ radium therapeutically. Although time has whitened his hair, he still stands head and shoulders above the great majority.

Dr. George H. Stover of Denver began his professional career in the days of the three-inch Crookes tube and continued actively in the science until his death in 1915. During his life he was a member of the American Roentgen Ray Society and contributed frequently to the *Journal of Roentgenology* as well as to general medical literature. His studious industry and broad vision advanced radiology materially.

EARLY TEACHERS

American radiology owes a great debt to the physiologist, Dr. W. B. Canon, who was the first to employ the salts of heavy metals in the study of the gastro-intestinal tract. It will be recalled that he was compelled, by the lack of power in the apparatus available at that time, to use geese and cats for his experiments. By employing animals with thin bodies he was able to get quite clear fluoroscopic and radiographic images. On the foundation laid by Dr. Canon has been built the whole superstructure of gastro-intestinal examination of today. The published report of this early work appeared in the *American Journal of Physiology*, 1901-2, page 251. Since that date much has been contributed by this eminent physiologist toward the solution of those problems which the radiologist meets in actual practice every day.

Dr. Charles R. Bardeen, Dean of the Medical School, University of Wisconsin, and Professor of Anatomy in the same institution, has done more than any other American anatomist to render the study of anatomy a clinical subject by employing radiology in teaching it. His study of the development of the carpal bones stands out as a vivid illustration of the value of this method of teaching. His study of the heart by fluoroscopic observation and radiographs has been of inestimable value to the medical profession in general and the specialty of radiology in particular.

It will be recalled that the work of the late Dr. James G. Van Zwaluwenburg was done at the University of Michigan. Although only fairly started in this important work at the time of his death, he contributed largely to the advance of American radiology. His work on the employment of pneumoperitoneum in gynecological examinations was a distinct contribution to the subject. His term "pelycography", coined to describe this kind of examination, is descriptive and useful. Much other work was under way and American radiology lost much in his death. It is indeed fitting that his mantle has fallen on so able a successor as Dr. Preston M. Hickey, whose ripe clinical experience should enable him to go on with the work so ably begun by his predecessor.

EARLY CLINICIANS

By those who have followed the development of American radiology it will be remembered that in the early period there grew up what might be called two schools of diagnosis. The one branch held that plates were the only satisfactory method for making gastro-intestinal examinations, and the other branch contended that plates were unnecessary, since all the information could be gained by fluoroscopic examination alone. It is a happy moment which now makes it possible to say that these extreme views are no longer held. There are several living radiologists who took an active part in the controversy when it was at its height. Perhaps the most outstanding follower of the plate method of gastro-intestinal diagnosis is Dr. Lewis Gregory Cole. He brought the method to a state of perfection attained by none other on this continent. To follow his careful diagnosis to the operating table and see such a high percentage of diagnoses proven correct is to be impressed with the accuracy and ability of this master diagnostician. His frequent contributions to medical literature have justly clarified the problems of gastro-intestinal diagnosis.

Of the men who might be termed followers of the fluoroscopic method, Dr. R. D. Carman is a conspicuous example. It will be accepted without argument that his accuracy as a diagnostician in gastro-intestinal lesions ranks high. Practically half his time is spent in the surgical operating room studying the pathology which he has previously visualized under the fluoroscope. Can any one suggest a more profitable method of connecting the x-ray examination with actual pathology?

EARLY PHYSICISTS

This discussion would not be complete if the name of Mr. Clyde Snook, electrical engineer and physicist were omitted. Mr. Snook was the inventor of the so-called "Interrupterless Transformer." This type of apparatus has superceded all others in America and is rapidly being adopted in other countries. This invention made possible a rapid advance in radiology.

Mr. W. D. Coolidge, Ph. D., solved the problem of the hot cathode tube and made this solution practical in the Coolidge Tube. This invention, combined with the interrupterless type of transformer, is responsible for the present high state of radiology. The Coolidge tube is primarily the foundation of the present deep therapy technique. The Coolidge tube rendered practical the self-rectifying type of x-ray unit. In fact, to think of modern radiology is to think of Coolidge. He is an honorary member of both the American Roentgen Ray Society and The Radiological Society of North America.

Early in the development of American radiology Professor J. S. Shearer, Ph. D., became interested in the physical problems of the science. To his untiring efforts are due the solution of many problems, such as the most effective voltage for radiography, the action of different qualities of x-rays on silver emulsions, the effect of different thicknesses

of filters on x-rays, etc. Early in the war he was made Chief Consulting Physicist to the X-ray Department of the United States Army. He was placed in charge of a school of instruction for medical men entering the x-ray service of the army. He was chairman of the committee on x-ray protection appointed by the American Roentgen Ray Society. His untimely death cut short a highly valuable work when only well begun.

Professor William Duane, Ph. D., has attacked the physical problems of x-ray and radium with characteristic aggression and vision. To his untiring effort may be attributed the solution of many of the physical problems involved in the present deep x-ray therapy. Dr. Duane is now applying the purely physical knowledge which he has gained to the actual treatment of patients, and some wonderful material should result from his work, because he is bound to get a better idea of the clinical effect of various forms and intensities of radiation by this method. His work in radium research has become especially well known, and to him is accorded the honor of inventing an apparatus for collecting the emanations given off by radium.

THE HAND WRITING ON THE WALL

Brief mention has been made of some of the men who have blazed the trail leading to the present state of radiology in America. It will be noticed that medical clinicians, physiologists, electrical engineers, physicists, anatomists, teachers, and radiologists have all contributed to the science. The list of those who have added materially to the wealth of data and scientific findings which is now the common property of radiologists is a long one. If it were possible to do so here, there would be considerable pleasure derived from the compilation of a complete list of such men as Dr. Emil G. Beck, who was the first to use the stereoscopic method in x-ray examination; and who, though a surgeon, has contributed prodigiously to radiological literature.

The fact which must be recognized as unequivocal is, that all branches of medicine and the allied sciences have had an important part in the formation and development of the science of radiology. It is but natural, therefore, that radiology should be called upon for aid in diagnosis and treatment in a wide range of cases and subjects.

Some idea of the extensive use made of radiology at the present time may be gained by examination of the annual reports of various hospitals. In the larger institutions, approximately 80 per cent to 90 per cent of the total number of patients hospitalized pass through the electro-therapeutic department. Electro-therapy seems to be more extensively employed in America than in other countries. This is demonstrated by comparison of American statistics with those of institutions in England, for example, which undoubtedly ranks well in the forefront in radiological activities. The report of the Manchester Royal Infirmary for 1920 shows 11,550 admittances. Of these 9,203, or slightly more than 71 per cent, passed through the x-ray, electrical and massage departments.

Facing the record squarely, it is impossible to refute two conclusions: (1) that radiology as a science actually makes closer and more intimate contact with all phases of medical practice than does any other specialty of medicine; and (2) that in order to practice his science conscientiously and successfully, the radiologist must not only be well grounded in the fundamentals of, but always keep fresh on the latest authentic knowledge concerning, the numerous aspects of medicine, both preventively and curatively.

No other specialty in medicine is so far-reaching or exacting in its requirements. Dr. S. B. Childs is the author of the statement that "The radiologist must be a good internist, and add to that his knowledge of radiology." But

even so comprehensive a statement does not seem sufficiently broad or inclusive enough to scope the actual fact.

It seems clear that the radiologist who hopes to hold the confidence of the medical profession, as well as the public to which he ministers, must at his peril, display at all times an accurate and personal knowledge of all phases of medical science. He must know anatomy, physiology, pathology, and so on through the whole category, so that he can at all times give unmistakable evidence of the fact that he is a masterly combination of clinician, internist, and radiologist. Nothing but grief can attend the dabbings of that man or woman afflicted with dilettanteism who chooses the science of radiology for a profession under the misapprehension that it affords an easy way to an affluent existence.

There is plenty of evidence on every hand to show that radiology is being looked upon with increasing respect. Indicative of this trend is the striking illustration found in the recent action of the Mayo Clinic, at Rochester, Minn., where, according to information just received, a most complete and fully equipped electro-therapeutic department has lately been installed. That institution has, of course, used the x-ray extensively for diagnostic and therapeutic purposes for a good many years, and has also employed radium therapeutically in a great number of cases. But the electro-therapeutic department has been quite materially enlarged by the addition of many devices, including in this the ultra-violet. This fact is especially significant when it is remembered that the Mayo Clinic has always been primarily a surgical institution.

In order to guard against the false assumption that radiology as a science has become so thoroughly entrenched that no further effort at development is necessary, attention is directed to the axiomatic rule of conduct that before a man can command public respect he must first have developed in himself a high degree of self-respect. This applies to the radiologist as much as anybody else. And it is cited here for the purpose of bringing to radiologists everywhere an appreciation of the responsibilities falling on them as individuals, the result of the attainments of men like those alluded to in earlier paragraphs.

So much remains to be done in an investigative way for the scientific determination of a plethora of chaotic conditions that failure can only be accepted as incontestable proof of an absence of that degree of self-respect which justifies public confidence. Quite naturally, this involves an extravagant expenditure of energy and time in the study of all phases of medical science in their relation to the science of radiology, as it also involves an intensity of devotion to the science of radiology which excludes for once and all, all useless indirection and wobbly pussyfooting. This is the standard fixed by the men mentioned as the builders of the science.

A wonderful opportunity, surrounded by every imaginable fortuitous circumstance, is within the reach of American radiologists. That they will arise, seize it, and make it their own for the advancement of all medical science and the benefit of the public, does not at the moment appear open to question. Too much has already been achieved to permit the intervention of such a catastrophe by the witting failure of the large body of American radiologists, struggling forward to the limit of their capacity under the wise counsel and painstaking assistance of men of unimpeachable reputation in all phases of medical and the allied sciences.

American Registry of Radiological Technicians

AT the present time the main purpose of the board appointed to conduct this registry is to foster the organization according to the rules and regulations laid down and adopted by The Radiological Society of North America. Sufficient machinery has already been established to begin

the registration of applicants. A good-sized number of applications are already on file. The necessary investigation of credentials and the arrangements for examination are being made.

This actual consummation of plans long studied and carefully arranged has stimulated other societies to see the need of some board to register radiological and radium technicians. We understand that the Canadian Radiological Society has named a delegate for this Board, though official action has not yet been received. Invitations have been sent to the American Roentgen Ray Society and to the American Radium Society to do likewise.

It is understood that some changes will have to be made in the plans now adopted if a larger representation is included. Should the Board undertake the registration of radium technicians special consideration must be given to their workers in accordance with the highest ideals of the radium workers.

Since the announcement of the plans for the registry some comments have been seen and some criticisms have been received by the Board. For instance, the trade journal, "Radium Therapist," published by the Radium Company of Colorado, in its July and August issues very kindly calls attention to the registry. They speak highly of the action of the Radiological Society in establishing such a board. But they regret that the lines were not drawn broad enough to include radium helpers. This conclusion is hasty. As in the organization of the Radiological Society of North America, so in the Registry the term "radiology" and all its various uses was especially adopted so that eventually all workers using any form of radiant energy might be included eventually. At present it requires only slight modification of the procedure to include radium technicians. Diplomatic negotiations with other societies may enlarge the Registry so that the radium technicians may be cared for by the same board. The American Radium Society has received an invitation to join in the conduct of the Registry.

A few well-meaning radiologists have written the Board, evidently with the idea in mind that the establishment of the Board is now under discussion, and have entered into lengthy argument for and against the principles involved. This is entirely beside the point. The matter of establishing a board was carefully studied over a period of years. There was no disagreement on the part of the various committees that a board is feasible and highly desirable, if the large army of technicians employed in our laboratories is to maintain a high standard or to be controlled.

The following excerpt from a letter recently received from one of our leading radiologists not only illustrates this point, but also refutes the very argument he advances against the recognition of technicians.

"To come to the point bluntly and unequivocally, I am out of sympathy with the entire project of the training of x-ray technicians as outlined in your letter. My reasons for being opposed to the training of technicians are briefly as follows: In the first place, I think it is a fundamental error for a roentgenologist to delegate the technical side of his work to subordinates. Necessarily, I, in common with many other busy roentgenologists, have to do this, but my view is that the roentgenologist should do his own technical work."

The answer to this is that he can not do his own technical work, because he does not have time, and therefore the trained technician is a necessity.

The Registry is an established fact, and until The Radiological Society of North America disowns its child it will continue to grow into maturity claiming parental care and recognition. From the present state of the infant's health it seems to have a promising future which will be limited only by the time and foresight of those directly interested.

EDWARD W. ROWE.

Roentgen Society Notes

SIR HUMPHREY ROLLESTON, President of the Royal Society of Physicians and Past President of the Royal Society of Medicine, has just been elected President of the Roentgen Society. As Chairman of the X-ray and Radium Protection Committee he has already rendered distinguished service in this field. Under his leadership the Society is looking forward to a very interesting year, which will mark the close of the first quarter century of its existence.

Sir Alfred Pierce Gould, one of the earliest workers in the field of radium, and a Past President of the Roentgen Society, died April 20th at Ashburton, England. He had just completed seventy years of a long and useful life, during which he distinguished himself not only as a surgeon, but as a preeminent worker in cancer research.

Rail Fares Annual Meeting

REDUCED railroad fares of one and one-half rate for attendants and adult dependents have been secured for the Annual Meeting, to be held in Detroit, December 4th to 8th.

These rates are applicable in the territory under the supervision of the following Passenger Associations:

Western Passenger Association, all lines, including New Mexico.

Canadian Passenger Association, eastern lines only.

Central Passenger Association, all lines.

Transcontinental Passenger Association, applies in all territory except "from Portland or points south through California," and "from California or Nevada." The Chairman of the Transcontinental Association states that "those traveling from California, Nevada, and from Portland and points south through California, may avail themselves of tourist fares in effect daily to Detroit, Michigan, and return of \$161.92 from San Francisco, Los Angeles and San Diego.

Southwestern Passenger Association, all lines.

New England Passenger Association, all lines.

Southeastern Passenger Association, all lines.

Trunk Line Passenger Association—rates will apply in New York state (east of Buffalo and Salamanca), New Jersey, Pennsylvania (east of Erie, Oil City and Pittsburgh) Delaware, Maryland, District of Columbia, Virginia and West Virginia (east of Wheeling, Parkersburg and Kenova).

In territory west of Port Arthur and Armstrong, Canada, under the supervision of the Canadian Passenger Association, Western Lines, no reduction in fares will apply.

The tariff conditions governing the rates in question are:

1. Minimum fare of \$1.00.
2. Identification certificate must be presented to railroad agent at point of origin, which will entitle the holder to purchase round trip ticket or tickets for himself and dependent members of his family to Detroit and return.
3. Selling dates, November 30th to December 6th.
4. Validation dates at Detroit, December 4th to 14th.
5. Tickets good leaving Detroit any day within final limit with the restriction that the final trip must be completed by midnight of December 14th.
6. Tickets must be used returning over the same route as going.

The identification certificate called for in the tariffs will be furnished through the Business Office in ample time, and all confusion incident to validation, such as characterized the Annual Meeting last year, will be avoided.

Attention is called to the fact that the identification certificate plan under which tickets will be purchased this year, is an entirely different plan than the certificate plan which obtained last year.

If, for any reason, any person contemplating attendance, and who is entitled to identification certificate fails to receive it by the middle of November, he should get in communication with the Business Office of the Society at Omaha as promptly as possible.

Canadian Radiological Society

THE Third Annual Convention of the Canadian Radiological Society was held in Winnipeg, Canada, in conjunction with the Dominion Medical Association June 20-23rd, 1922. The Scientific Session lasted for three days, and included a series of extremely interesting communications. We had the honor to have present with us and contributing to our programme. Doctors Lewis Gregory Cole, Russell D. Carman, B. H. Orndoff, R. H. Stevens, F. S. Bissell, and C. J. Sutherland.

The officers elected for the coming year are: President, Dr. L. J. Carter, Brandon; First Vice President, Dr. C. W. Prowd, Vancouver; Second Vice President, Dr. J. C. McMillan, Winnipeg; Third Vice President, Dr. L. T.

Pariseau, Montreal; Secretary-Treasurer, Dr. L. K. Poyntz, Victoria. The Executive Committee is composed of Dr. G. E. Richards, Toronto; Dr. A. E. Walkey, Hamilton, and Dr. L. K. Poyntz, Victoria.

The rules and regulations governing the Canadian Registry of Technicians established in 1921 were adopted, and Dr. L. K. Poyntz was appointed Registrar and Examiner.

L. K. POYNTZ.

New Officers of Western Society

AT the meetings of the Western Section and Pacific Coast Roentgen Ray Society, at Yosemite, May 15th, new officers of both organizations were elected, as follows:

WESTERN SECTION

M. P. Burnham, Chairman.....San Francisco
F. C. Swearingen, Vice-Chairman.....Pomona
Roy Payne, Secretary.....Portland

PACIFIC COAST SOCIETY

Raymond G. Taylor, President.....Los Angeles
Chas. M. Richards, Vice-President.....San Jose

As Chairman of the Western Section, Dr. Burnham will serve on the Executive Council at the Los Angeles meeting.

DEPARTMENT of TECHNIQUE

Technique for Cleaning Non-Washable, Non-Cleanable Intensifying Screens

GEO. M. LANDAU, M. D.
Chicago, Illinois

THE following process is carried out in the preparation of non-cleanable, non-washable screens:

1—Wash screen with ivory soap and warm water, using pledget of cotton as sponge.

2—Rinse well and repeat above.

3—Saturate pledget of cotton with alcohol and rub over screen surface lightly.

4—Dry screen and apply a coat of ordinary canning paraffin (softened only by the heat of the hand) by means of passing entire surface of paraffin

cake over screen surface. Apply in one direction only. After screen surface is entirely covered, rub wax in thoroughly by means of cheese cloth, changing the rubbing surface of the cloth frequently. Apply a second coat of wax, and repeat above procedure. The paraffin now affords a protection to the screen against dark room solutions and dust particles cannot be imbedded in the screen surface proper.

To clean the screen only a pledget of cotton saturated in alcohol is necessary to remove the coating of paraffin,

and with it the dust particles, etc., which have collected on the surface. This will leave the surface of the screen free from imbedded foreign particles, and it will be necessary only to rewax the screen. As a rule the screen need not be washed with soap and water again unless exceptionally dirty. Screens having been prepared by this technique three years ago are still doing service. To new screens only a coat of paraffin was applied. As to the effect on the speed of the screen, I am unable to notice any perceptible difference.



NEW EQUIPMENT

Hanovia Deep Ray Lamp

THE accompanying illustrations of the Hanovia Deep Ray Lamp suggest a unique piece of apparatus for those using electrotherapeutic devices. It will be observed that the mechanism of this lamp is so adaptable as to meet almost any immediate requirement in positioning.

With the present marked interest in, and increasing use of, electrotherapy, considerable attention is being paid by the medical profession to equipment of this character. That is especially true with respect to physicians who are not accessible to some well-equipped laboratory or hospital offering electrotherapeutic services. Many in the outlying districts are installing equipment of this kind because of the advantages to be gained in their individual practice, and the larger hospitals and sanitariums find constantly growing use for equipment of this character in the treatment of various ailments.

At the present moment, the Journal is not in possession of any specific information concerning the peculiar characteristics claimed for this deep ray lamp by the Hanovia Company from the strictly medical standpoint. The presumption seems justified, however, from an examination of the literature furnished, that it falls within the field referred to, and while it perhaps has no different biological or bactericidal qualities than others on the market, it will probably appeal to many on account of its flexibility and mechanical adaptability.

The lamp itself is substantially constructed throughout, and stands seven feet in height, which makes it possible to raise the hood out of the way of the operator when not in use. The hood is counter-balanced, being suspended by a flexible steel cable passing through a triple pulley swivel to a counterweight sliding inside the upright. The attachment of the cable to the pantograph bracket is made to a spring

safety lock, which, in case the cable should break, instantly grips the upright and prevents the lamp from falling. A locking device at the bottom of the lamp bracket clamps the bracket to the upright and prevents the hood swinging around on the upright in case the floor is not accurately level. The hood is held to the bracket by a conical

friction swivel, which allows it to be rotated and holds it in any desired position.

An adjustable stop is provided on the upright with a spring shock absorber to prevent the lamp being lowered beyond any point desired. The blue incandescent bulb of 1,500 watt capacity can be adjusted as to its focus by means of the little knob shown on the hood cap. This nut engages in a notched slot having four positions and produces at the lowest position an even diffusion of the light and develops a marked hot area at the highest position.

The illustration shows the outstanding features of this lamp.

A—Adjustability of lamp bulb relative to focus of hood to give four steps ranging from even diffusion to a pronounced hot area.

B—Pantograph bracket of ten-inch extension.

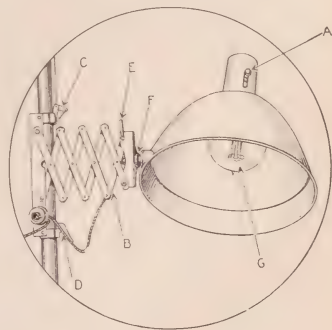
C—Patent safety lock, which prevents falling of lamp.

D—Locking device.

E—Pantograph extension brake.

F—Conical adjustable friction swivel.

G—1,500 watt incandescent bulb.



Nourse Lantern Slide Case

A VERY convenient case for carrying lantern slides is put out by Silas W. Nourse of Palisade, New

Jersey. Two views of the case, one closed and the other open, show the case in sufficient detail that it is only

necessary to say the case comes in three sizes, with a capacity of 125, 200 or 250 slides.

The case itself is neat, is easily carried, is provided with a lock cover and so constructed that the cover can be detached to avoid tipping over. This is especially advantageous when the

operator is working in the dark and prevents breakage. The interior of the case is provided with compartments so that the slides can be arranged in the order desired and as projected shifted

to the opposite side so that the slides always appear in proper rotation.

This sort of an appliance will be of interest to radiologists and others giving lantern exhibitions.



ABSTRACTS and REVIEWS

Heliotherapy in Tuberculosis. Horace Lo Grasso, M. D., Perrysburg, N. Y., N. Y. State J. Med., 22:281, June, 1922.

HISTORICALLY, the J. N. Adams Memorial Hospital has shown a significant and increasing practice in heliotherapy since the inauguration of that work in 1913. From the brilliancy of the results obtained the writer suggests that the medical profession generally devote closer study to the therapeutic possibilities of heliotherapeutic measures.

Rigorous attention to established details of technique are imperative for best results. Various indications, contraindications and supporting adjuvant measures are recorded. It appears that the prognosis is favorable in proportion as the patient becomes pigmented. Pain is promptly dispelled. Temperature becomes normal. Appetite returns. Weight and strength improve, as does also the condition of the blood.

There is presented a statistical table showing the results obtained in the treatment of surgical tuberculosis from 1913 to 1922 in many cases. Abridged, the findings are:

T. Bc.	Cases	Recoveries
Site of infection	observed	reported
Eye	15	93.7%
Glands	244	83.0
Pertoneum	63	81.8
Wrist and hand	15	78.0
Ankle and foot	13	72.2
Epididymitis	6	66.6
Hip	35	60.4
Elbow	4	57.1
Osteomyelitis	8	50.0
Knee	13	46.0
Spine	16	32.0
Kidney	4	16.4

The original table is more complete and includes also an expression of the percentages of arrested and improved cases, besides the failures. Lo Grasso says also that heliotherapy is equally as useful in conditions other than surgical tuberculosis: puerperal sepsis, anemia, rickets, osteomyelitis, non-healing wounds and convalescence from all wasting and infectious diseases; and, says the author, the established prophylactic qualities of the rays are more marked even than the remarkable therapeutic properties.

A. J. P.

Newer Aspects of the Rickets Problem. Alfred F. Hess, M. D., Jour.

A. M. A., 78:1177, April 22, 1922.

DR. HESS presents a review of a study centered upon the etiology of rickets, in which the roentgen ray interpretation of epiphyseal changes in the relation of vitamin factors in the dietary claim especial prominence as contributing to the modern development of the subject.

Although calcium metabolism has received most of the biochemist's attention, the writer points out the great and significant role assumed by the phosphorus ion.

But, to the student of radiant energy, the contribution is impelling, from the significant presentation of the cogent value of the factor of light in rickets. In summary, the newer advances are these: Light hygiene is as important as dietary hygiene; ultra violet energy is an integral function regulating the appearance and disappearance of rachitic symptoms (as measured clinically and by the x-ray). The quality and quantity of ultra violet radiation is the essential factor—the quality being determined by photospheric filtration, and filtration through glass, the quantity being estimated from the seasonal incidence of the condition.

There are other far reaching experiments recorded, as, for instance (again pointing to selective filtration) the combined effect of pigmentation, the diet and ultra violet energy. There is intimated here the biologic sensitization conferred by certain ions. It is strikingly significant to observe that under the direction of this same author, earlier and empiric attempts in the use of ultra violet energy in rickets resulted in findings that were as disappointing as the recent attack, scientifically evaluated, was successful.

A. J. P.

Syphilis of the Aorta. C. W. McGraven, M. D., and Ernest Scott, M. D., Ohio State M. J., 18:477, July, 1922.

THE experience of these writers is that the cardiovascular system is the most frequent and vulnerable point of attack for the spirochetes. While the physical findings are of great value in the recognition of aortitis, the fluoroscope and radiograph is the most accurate and certain means of recognizing the condition and determining its extent.

Every luetic patient should be suspected of having aortic or cardiac in-

volvement, and this should be watched for with the same care with which one looks for an endocarditis in rheumatic fever.

Seven illustrative cases are given with radiographs (Dr. J. H. Vorhees, roentgenologist), showing aortic enlargements and aneurisms.

W. W. W.

A Case of Apparent Dextrocardia—Disproved by Instrumental Investigation. John Walker Moore, Kentucky M. J., 20:392, June, 1922.

THIS interesting case illustrates the possibilities of deceptive physical findings. There was an impulse, corresponding to a heaving "apex" beat in fourth and fifth interspaces just internal to the right nipple, and no visible apex beat to the left of sternum. The writer and an intern found all the physical signs to the right of the sternum instead of the left.

The electrocardiogram and the fluoroscopic examination showed a perfectly normal heart in the usual left sided position, the x-ray image extending four fingers breadth, to the left and only three to the right of the sternum.

W. W. W.

Some Observations on Endoscopy with Report of Four Cases. C. N. Peeler, M. D., and C. C. Phillips, M. D., Southern Medicine and Surgery, June, 1922.

In endoscopic work, the introduction of the instruments is an easy task, but the plan of procedure in removing the foreign body is the great difficulty. The surgeon must have a mental picture of the location, position and relation of the body to surrounding tissues. In this, the x-ray is indispensable. With the opaque foreign body the task is easy, the only point which requires special attention being to determine whether the body is in the esophagus or the air passages. In the case of a non-opaque foreign body, the difficulties are greater; the signs, although few, are conclusive. The signs in the radiogram are emphysema of the obstructed lung, with widening of intercostal spaces, diaphragm depressed on affected side and mediastinum displaced toward the opposite side. On the fluoroscopic screen, the diaphragm is limited in motion or immobile on the affected side, with exaggerated movements on the opposite side.

The cases reported were (1) open safety pin in esophagus; (2) (prob-

ably) small pieces of cocoanut in bronchi; (3) half of peanut in right lower bronchus; (4) diagnosis of foreign body in left bronchus, proven to be congenital stenosis of same.

W. W. W.

Radium Emanations in Exophthalmic Goiter—Blood Vessels of Adenomas of Thyroid. Wallace I. Terry, M. D., Jour. A. M. A., 79:1, July 1, 1922.

THIRTY-THREE cases of exophthalmic goiter have been treated by radium emanation at the University of California Hospital. Only patients suffering from an extreme degree of hyperthyroidism has been treated and only with the idea of rendering them better risks for major surgical operations.

The skin at the selected sites for treatment is first chilled by use of a cotton sponge saturated with ethyl chlorid. The tubes are then introduced by means of a small caliber, hollow needle and are pushed into place by a plunger. Six emanation tubes containing a total of from six to ten millicuries are inserted into the upper, middle, and lower thirds of each lobe through one skin puncture on each side and are buried one-half centimeter in the thyroid. No adhesions have resulted from this treatment except minute ones where the needle has entered the gland. Tubes as well as needles are sterilized by boiling.

Final results have been obtained in 16 of the 33 cases—ten patients are definitely cured after resection. One of these had diabetes mellitus, which has since disappeared; another with profound toxemia with jaundice, practically moribund at the time of treatment, is now well except for a slight irregularity of the heart. In two cases apparent cure has resulted from use of radium alone; in these two there was a remarkable fall of the basal metabolic rate. Four cases died; three of these died after resection, one dying from acute hyperthyroidism, one from recurring hyperplasia of the thyroid and marked hyperplasia of the thymus, with terminal pneumonia, and the third from acute yellow atrophy of the liver. A fourth one died three months after radium, cirrhosis of the liver being the cause of death.

Neither simple colloid goiters nor adenomatous goiters have been treated with radium emanation. It is conceded that it might be worth a trial in the former, but not in the latter type, for fear of producing atrophy of the thyroid gland and consequent hypothyroidism.

Basal Metabolic Rating as a Basis of Classification and Treatment of

Thyroid Conditions. Hamilton P. Jones, M. D., New Orleans M. & S. J., 75:28, July, 1922.

ON the basis of the rate determinations the treatment outlined is as follows: In hypothyroidism, subnormal rate, thyroxin, thyroid extract and iodine may be used, but not x-ray or surgery. In malignancy or tuberculosis everything available may be used, including surgery, radium, x-rays, thyroid extract, etc. Colloid adolescent goiter, normal basal metabolic rate, is an essentially non-surgical condition and is not to be treated by radium or x-rays. In simple adenoma conservative treatment is called for. In toxic adenoma and exophthalmic goiter treatment may consist of surgery or of radium and x-rays—preferably radiotherapy should be tried first.

W. W. W.

Diagnosis of Pulmonary Tuberculosis. Louis Hamman, M. D., Southern M. J., 15:523, July, 1922.

IN spite of the persistent, vigorous and comprehensive campaign of education of the past twenty years, the early stage of tuberculosis still eludes us. This is due to the indifference of patients in this stage, the negligence of physicians, and the difficulty inherent in expert pulmonary tuberculosis. The diagnosis of tuberculosis consists in making a distinction between infection and disease.

In considering the part that roentgenology plays in the diagnosis we must not forget that the x-ray examination is only a part of the physical examination. There is nothing characteristic of tuberculosis in the physical signs themselves, but the location of them is of considerable importance. One of the great advantages of the x-ray is that an accurate and permanent record of the lung density at the time of the exposure may be thus obtained. It also reveals the pulmonary changes in greater detail and it may show surprising changes in a lung which revealed nothing abnormal at the physical examination. "If you discover slight abnormalities the x-ray will show more extensive lesions." The great shortcoming in physical examination is the difficulty of distinguishing between active and inactive lesions and the same thing is true of x-ray examination. The detection of apical rates is the one feature of physical examination which has an advantage over the x-ray. The x-ray is indispensable to an accurate pulmonary diagnosis but no physician should rely solely upon this for his diagnosis. The physician and the roentgenologist should work in close co-operation.

W. W. W.

Thyroid Therapy. R. G. Allison, M. D., Minnesota Med., 5:404, July, 1922.

THIS paper reports results obtained on material coming under the observation of the medical service of the University Hospital during a period of about 20 months. This material consisted of 27 cases of Graves' disease, not operated but treated with x-ray. Twenty-four of these are well from the clinical and laboratory standpoints after eight months.

All cases were treated with a standard dosage at three week intervals. Technique was 30 milliamperes minutes through 4 mm. of Al and one thickness of leather at an average distance of 8 inches and a gap of 8 inches between blunt points. Three portals of entry were employed, one over each lobe and one over the thymus. If improvement was not marked after the fourth treatment the time was increased to 34 milliamperes-minutes.

The closest co-operation between the internist and the roentgenologist is insisted upon, so that the clinical observations and metabolic determinations shall be carefully watched.

W. W. W.

The Dose of Radium. Heber Roberts, M. D., Illinois M. J., 42:15, July, 1922.

DR. ROBERTS read this paper before the Illinois Medical Society in November, 1921. In it he reviewed the history of radium dosage from 1903 to that time. The following paragraphs are excerpted: "All apparatus thus far contrived for measuring these wide variations of radiance at the therapeutic end is a failure. Ionization is the ray effect, and the number of rays absorbed determine the number of ions. This is the nature of the dose. Reaction occurs in the cells where the rays are absorbed.

"The dose of radium is now put forth with the claim of great exactness; but it is theoretical." Speaking in this connection of simple mucocutaneous cancers he says: "The fact is the emanation needle is a dying product hour by hour. It is impractical, for experience has shown in actual practice that radium must rather increase in radiance than diminish. Diminishing dosage begets tolerance in malignant cells. Tolerance means stimulation and cell proliferation. At first the emanation is very destructive. A film is formed about the needle, which becomes a foreign substance in any tissue. This acts harmfully by (1) adding a filtering crust, (2) leaving an irritating foreign substance * * * My card index reveals that nearly all physicians writing about the superiority of the emanation are those who have recently come into

the fold, and their ability as advocates surpasses their clinical findings. I am in complete accord with those using the emanation needle in deep therapy. No one has been able to apply a fixed therapeutic theory successfully to pathology. * * * Radium is not a cureall. Diagnosis is usually an hypothesis; so no one should rely too much upon the type of the disease for the dose. In every case judgment should be in evidence and there should be some knowledge of the physics of radium, and also some experience. * * * Patients have died from disease induced by radiant matter.

"Look lightly upon foreign literature when seeking the dose of radium. The Freiberg teaching by Koenig and Friedrich is to use heroic doses, and the Hamburg school, headed by Albers-Schoenberg is moderate in its radium therapy."

Treatment of Vascular Naevi. E. H. Molesworth, M. B., Ch. M., Sydney, Australia, M. J. Australia, 1:576, May 27, 1922.

CERTAIN limitations and difficulties in the treatment of vascular naevi exist. The superficial port-wine stain is not nearly so amenable to treatment by radiation as is the protuberant naevi of the strawberry variety and an actively growing naevus is much more easily treated by radiation than one which has attained full growth. The first six months of life is therefore the most favorable period to attack these, and an almost perfect result may be obtained with eventual obliteration of the scar. Radiation undertaken later than the first six months of life may perhaps be preferable to any other form of treatment, but once the naevus has become fixed results are never so good, and in cases of adult naevus if a single dose of radium or x-rays fails to produce a noticeable improvement treatment should be at once discontinued, as continued applications would produce very harmful results. Too heavy treatment is dangerous.

Electrolysis is useful only in cases of spider naevi. This method as well as cauterization often leaves bad scars and besides both are very painful methods. Carbonic acid snow is recommended if radiation is impossible and if this method is impossible then excision is the next choice.

"In suitable cases the method of procedure is as follows: A three-quarter or a full erythema dose of medium to hard (four to six B. W.) x-rays is delivered in one sitting. Of course, the naevoid area alone is irradiated, the surrounding skin being protected either by a suitably-sized localizer, or, if such be not available, by a sheet of lead foil

or lead rubber tissue with a hole the size of the naevus cut into it. The effect of the application is, of course, not at once apparent, but at the end of ten days there is generally a noticeable engorgement of the naevus, is quite transitory and followed a week later by distinct flattening and paling of the growth. Three or four weeks after the first application a second dose may be administered; this often results in the complete disappearance of the blood tumor. A third or even a fourth application may be required, but if full erythema doses have been given it is rarely necessary to continue further. Naevi which resist treatment partly or entirely by this means, in my opinion, should be dealt with by some other means of treatment."

The Use of X-rays in Diseases of the Skin. G. E. Richards, M. B., Canadian M. A. J., 12:478, July, 1922.

FOR ringworm of the scalp, treatment must be preceded by shaving, or at least clipping the hair very short. The scalp is then divided into four areas which are treated in rotation, the dose being evenly distributed and so measured as to produce complete epilation, after which "the ringworm of the skin surface * * * can easily be destroyed by the usual applications."

Favus is similarly treated. It is better to treat sycosis and folliculitis barbae by small divided doses "in the same manner as other chronic infections of the skin" and treatment must be continued for some time to destroy all foci of infection. Epilation of the whole area, however, is unwise if the infection is extensive.

Lupus vulgaris is easily, inexpensively and effectively treated by x-ray.

Epithelioma of the skin, if treated before ulceration or increased growth has taken place, yields in nearly 100 per cent of cases, but if attempted in the latter stages treatment is not so successful. Epithelioma of the lip, if not deeply infiltrated, may be successfully treated by unfiltered radiation, but heavily filtered radiation will be necessary in infiltrated cases. In any case the submaxillary glands should be treated by heavily filtered rays.

Rodent ulcer, if it has not involved bone or cartilage, or if it has not been previously treated, will usually yield. Severe reaction at the very first treatment must be sought. Long continued protracted doses will lead to failure.

The whole group of eczemas are successfully treated by x-ray. Psoriasis gives erratic results, but a trial is justifiable. Acne vulgaris and chronic furunculosis, as well as carbuncle, respond very favorably with the exception of

the carbuncle which occurs upon the back of the neck. About three-fourths of an erythema dose is used for this lesion. Dosage in all above lesions must be kept under the point of erythema.

Etiology, Pathology, Prognosis and Treatment of Acne. Charles H. Ball, M. D., J. Oklahoma M. A., 15:198, June, 1922.

AFTER outlining the general and local treatment for acne, both of which are essential, the author dwells at some length on the x-ray treatment. The rationale of this therapy depends upon the fact that the activity of the sebaceous glands can be diminished and exfoliation produced, thus sterilizing the skin. The amount of x-ray will depend on the type of acne. The successful treatment depends upon a flexible technique which adapts the dosage to the needs of each case. Acne requires more experience and judgment to produce results than any skin disease treated by x-rays.

Acne is an entirely remediable disease in every case when properly managed. He believes that the benefits of vaccines, when they have any benefit at all, are more or less transitory.

W. W. W.

Congress of Radiology and Physiotherapy. Brit. M. J., 1:958, June 17, 1922.

THE whole of the first day was spent in discussing the normal and abnormal stomach as studied by the x-rays. The discussion was opened by Dr. Barclay, who stated that the stomach, being one of the most flexible and sensitive muscles of the body, can, therefore, alter its shape very greatly and still be normal in shape. Dr. Gilbert Scott said it was as difficult to describe the normal stomach as it would be to describe the normal face.

In discussing the best methods of examination of the stomach one school held to the view that the screen view alone is of value, the other held that it is of less value than the plate method. Palpation was much discussed—almost all agreed more or less as to its value in diagnosis of ulcer with the exception of Dr. E. I. Spriggs, who stated that absence of pain on palpation is not negative in diagnosis of ulcer.

The discussion of deep-seated radiotherapy occupied three sessions of two days. Both support and criticism of the German methods found place here. Dr. Vilvandre begged radiologists not to let national pride or prejudice divert them from the path of pure science. Dr. Finzi said that the future technique would call for 1,000 kilovolts instead of 200 or 300 and that radiotherapy would then be much simpler, more accurate and more effective.

Mr. Sampson Handley said that he believed radium tubes should be placed in a ring just outside the visible focus of disease and that the growing edge of the infection was the important thing, and heretofore too little considered, as was also true of microscopical extension. Also he said that he believed that in placing radium tubes into the mediastinum extensive surgical procedure would soon find a place.

There was a general agreement that radium and x-ray should accompany each other in the treatment of malignancies. Mr. Hayward Pinch of the Radium Institute said that the use of surface applicators for radium was not ideal, but often necessary, and that he believed that surgical procedure would be called in oftener in the future to assist radium treatment and that larger quantities of radium would be used.

Some remarkable photomicrographs of cancer cells and their changes were shown by Professor Daels of Ghent.

The Present Status of Radiation Therapy. D. Y. Keith, M. D., Kentucky M. J., 20:411, June, 1922.

THIS paper gives a general review of the development of radiation therapy and methods of measuring dosage. It briefly describes the objects sought in the newer technique of high voltage therapy, by means of which a more effective dosage is delivered to internal malignancies.

Three cases illustrate the many points in this paper, written for the general practitioner. One case was a carcinoma of the sigmoid and rectum, discovered accidentally during an operation for another lesion. The patient was given two series of intensive radiations, and one year later was in the best condition of her life, with her weight increased from 119 to 155 pounds.

The second case was a carcinoma of the ovary with metastases, inoperable. Treatment was by radium only, administered through the vagina, high filtration. Patient was still alive one year after the operation which had disclosed the condition.

The third case was a carcinoma of the prostate, disclosed at operation. Patient received intensive x-ray therapy and now, after one year, is able to attend to business and is free from pain.

The conditions amenable to radiotherapy are outlined.

W. W. W.

Surgery Versus Radiation. Francis Carter Wood, M. D., Long Island M. J., 16:258, June, 1922.

IN the conclusion to this paper Dr. Wood states that the title should have been "Surgery Plus X-ray Plus

Radium." "Each has its rightful place in the treatment of cancer and by an intelligent combination of operation with radiation better results in the treatment of neoplasms will undoubtedly be obtained in the near future. But at the present moment we are still far from having any very effective control over the cancer situation."

Radiotherapy does not cause great damage to the tissues, but its painless quality is not so general as is sometimes proclaimed, the pain from the insertion of needles and the nausea and depression consequent upon treatment often lasting for days or even weeks. The important question, however, is whether it cures or not, and to this the writer replies that the evidence is not yet clear nor satisfactory and that there is still much to be learned before radiation treatment will be upon a satisfactory basis. He says it "as yet impossible to judge whether or not radium or x-ray produces permanent cures of any malignant neoplasms except the basal cell tumors of the skin." Myeloid sarcoma of the long bones is noted as a possible exception to the statement just quoted. "Carcinoma of the cervix is one of the most promising fields for radiation."

Since the technique of radiation treatment has passed out of the realm of pure empiricism only within the last few years, he states that it is impossible to be sure as yet that it does cure malignancies, except clinically, and "Inasmuch as surgery has to its credit a large series of permanently cured patients, it is in my opinion still unjustifiable to substitute for it any other procedure until an equally good body for the latter is obtained. * * * Animal experimentation has shown that tumors exposed to large doses of either radium or x-ray reappear only after long periods of time, and I believe that in judging of radiation results it is necessary to extend the five-year period. Even without this extension the figures, although presented by the most optimistic worker in the vineyard, do not as yet in any way equal the final results of surgery."

As to pre-operative and postoperative raying, he says: "Intensive raying of the growth only, with very heavy doses lethal to all the tumor cells exposed is a possible procedure, but only in tumors near the surface, in which the growth and the entire radiated skin area is excised within twenty-four hours. Postoperative raying, when properly done, in the opinion of many reliable radiologists produces important results. The technique is still in the process of development and there is much to learn, but as it supplements the work of the

surgeon the procedure should never be omitted."

Dr. Wood states that tumor surgery must be greatly improved and extended, must become bolder and must be applied in more carefully selected cases than it has been in the past.

In the discussion following this paper Dr. William Francis Campbell said that operative methods for the cure of cancer have reached the limit of their anatomical perfection, that there is no way of extending or refining the operation and yet the cures are lamentably few and he wonders if it would not be better to abandon any but extirpation of the primary focus and leave the rest to radiation, which will seal up the avenues of invasion rather than opening them. He believes that the stage has not yet been reached where one may ask whether surgery or radiation is preferable for a malignancy, but that surgery plus radiation should be the treatment. Dr. J. Bion Bogart said he wished to support the views expressed by Dr. Campbell. He added that he had given up operating for cancer of the cervix, believing radium to be better for such cases.

An Experience With Radium. T. H. Dreher, M. D., J. S. Carolina M. A., 18:158, June, 1922.

THIS paper was read before the South Carolina Medical Association in April of this year, bringing a serious charge against radium therapy.

A case of uterine growth, the subject being the writer's wife, was treated with radium at a sanatorium ranking among the highest in this country, and where the writer took his wife for treatment with the utmost confidence. The results were disastrous and all but fatal. The writer feels that a great mistake was made and charges that it was unacknowledged as well.

In the considerable discussion following the reading of this paper, while the greatest fairness was observed, no one denying that a mistake had been made, and the greatest sympathy and regret expressed, nevertheless unreserved condemnation was not upheld. Radiotherapy in general and the particular institution where the mistake was alleged to have taken place were stoutly defended even by those whose sympathies were the most deeply stirred.

Dr. Deaver had been quoted as condemning radiation. Dr. Charles Mayo and Sir Benton McKenzie were both cited as having rebuked Dr. Deaver a day or two after he was reported to have utterly discountenanced radium therapy.

Radium with Special Reference to Disease of the Female Pelvis. John B.

Deaver, M. D., L. L. D., Therap. Gaz. 46:457, July, 1922.

DR. DEAVER'S much discussed attitude toward radium therapy can be accurately ascertained from the following excerpts from the above paper, which was read before the College of Physicians of Philadelphia:

"In the legitimate and truly scientific field, so anxious is the profession for real light in the pursuit of its course toward eliminating physical suffering, that there is danger of smothering each new discovery in an over-enthusiastic embrace. This applies with particular emphasis to radium in the treatment of cancer." He goes on to say that most of the exaggerated reports about radium may be blamed to the public press, and to say that his paper is an attempt, not to belittle radium, but to correct some false impressions which have been created mainly by the lay press.

"No right thinking person for a moment denies the palliative effect of radium in the treatment of advanced or inoperable cancer, nor does any one doubt its curative value in certain types of superficial external cancer. A careful study, however, of the literature shows that really scientific observers agree that radium is not the panacea which the lay mind has been led to think it is. Furthermore, there is an almost general consensus of opinion that radium therapy is still in its experimental stage, coupled with the desire that its future development will be such as not to frustrate the ardent hopes of the many thousands who are placing confidence in it."

Taking up the specific subject of internal tumors he says: "On the whole, Baish, once an enthusiastic radiologist, frankly states that 'the high hopes aroused by radium have not been realized.' Good results are obtained only in very early cases, while in the latter and advanced ones the end results are not any more satisfactory than those obtained by radical operation. On the other hand, recurrences after radium treatment seem to grow and metastasize much more rapidly than recurrences after operation, and do not yield to radiation, while the operated cases with recurrences are said to be not quite so intractable."

Citing an operative mortality of five per cent and five year curability of 27.6 to 34.2 per cent from Graves, Pemberton and Cobb, he says: "It is in view of such figures that operation in operable cases should still be considered a choice, if not the chosen method of treatment, for cancer of the uterus and uterine cervix." He cites varying opinions regarding pre-operative radium treatment. "Postoperative radiation, however, is more generally

approved as a possible means of destroying cancer cells that may have escaped the knife at operation. The combined treatment is by many considered more successful than one or the other alone, although Clark and Keene warn against radiation soon after operation on a fresh operative field. * * * I am inclined to think, however, that the best results will be obtained by a combination of radiation and surgery; that is, provided the patient is otherwise in good condition, operation after the first or second reaction from radium. * * *

"In benign disease of the uterus and adnexa radium therapy occupies a prominent place. I need scarcely stress the point, however, that the presence of inflammatory disease of the uterine appendages constitutes a contraindication to the use of radium in otherwise favorable conditions for its application. * * *

Personally, I cannot subscribe to the use of radium for uterine fibroids, except where there are definite contraindications to operation. The mortality for operation in fibroids in my hands is so small that I cannot conscientiously advise radium except for the reason above indicated. The artificial menopause which it may produce in young women is to say the least serious, while the results are not too inviting in the woman at or beyond the menopause. No one can ever be sure that there is not some latent chronic infection in the fallopian tubes. I speak from experience in making this statement because I have in mind several instances that have come to operation for just such a condition, where radium applications had been made by the so-called expert. In two instances at least, both occurring in the same year, I have known death to result from pelvic suppurative following the application of radium for small uterine fibroids. Fistulae, necrosis, fibrosis, are some of the sequelae of the application of radium, but I have never experienced any of these morbid conditions after operation for fibroid.

"Whatever may be the future of radium therapy, the fact remains that it is today not the panacea for cancer the advent of which is so eagerly being awaited, for in numerous cases in which it is most needed it has not as yet fulfilled expectations."

A British Medical Association Lecture on Radium Therapy. Robert Knox, M. D., Brit. M. J., 1:631, April 22, 1922.

NEW therapeutic agents pass through the stages of over-estimation, depreciation, and sometimes rejection. In such an agent as the radio-active substances great care is necessary in esti-

imating their value and even an approximate estimation is exceedingly difficult.

Much useless discussion has taken place as to the relative value of the x-ray and of radium because, given equal wave lengths of either, the effect must be the same. The real difficulty lies in the fact that it is impossible as yet to perfect an apparatus which will make available x-rays equal to the gamma rays of radium, since a voltage of from one to two millions is required to produce an x-ray equal to the hardest gamma ray of radium.

In a discussion touching upon the physics of x-ray it is noted that the chief difference between x-rays and light rays is one of length, the x-rays having wave lengths about 5,000 times shorter than light waves. Only about one octave of light waves is visible to the eye. The radiologist's path is much more difficult than it would otherwise be and the results often not what they should be because even such elementary knowledge of physics as the facts just noted have faded from his sight since he first studied physics.

Radium is defined as: "The prominent member of the uranium series of radioactive elements, belonging to the alkaline earth group of elements. Its parent is ionium and its disintegration product radium emanation." As generally used the word radium signifies a radium salt, and it is more accurate to state the radium element of the salt in speaking of other salts which are used in radium preparations. An explanation of beta and gamma rays is made and the alpha rays mentioned.

Action of radiation upon the tissues is next discussed. In the following outline Dr. Knox indicates the present situation with regard to choice of treatment:

Non-Malignant Growths

1. Port-wine stain, so-called—use care in treating, else the disfigurement will be worse than the original condition.
2. Angiomas—entirely removed from the surgical field.
3. Uterine fibroids—radium and x-rays the treatment of choice in 40 per cent of cases, but proper selection very necessary.
4. Uterine hemorrhage—radium almost a specific, but cause of lesion should first be ascertained in consultation with the gynecologist. In subacute and chronic leukorrhea radium found efficient where other measures have failed.
5. Bladder papillomata—radium used after operation or fulguration.
6. Goiter—agent of choice is exophthalmic goiter, useful in inoperable hypertrophic goiter.

7. Leukemias—offer a large palliative field. In many severe leukemias it is believed that raying the spleen, with transfusion, is the treatment of choice.

8. Enlarged thymus in children—Heublein believes radiation is the treatment of choice.

9. Cataracts—recent reports favor radiotherapy for this.

10. Tuberculous adenitis—Knox believes that a surgeon seeing results following treatment by radium and x-rays would adopt it at once either with or without surgery.

Malignant Growths

1. Skin cancer—if inoperable radium treatment of choice.

2. Lip cancer—if springing from the skin surface radium occasionally is used; if from the mucous membrane, and in a very early stage, surgery and radium should be used and x-rays used over the glands of the neck and chest. The advanced cases call for radium, and x-rays over the growth and the glands of neck and chest.

3. Cancer of lingual and buccal mucous membrane—radium and fulguration. The knife must not be used for these lesions. Salvarsan is used at the height of the radium reaction for secondary effects.

4. Malignancy of antrum—operation plus radium, glands rayed.

5. Cancer of the esophagus—if in an early stage combine radium and surgery; for later stages radium is a palliative, but in any case great care must be exercised, as the danger to adjoining tissues is especially great.

6. Stomach and intestines—surgery, plus radium, if possible.

7. Breast—surgery and postoperative radiation in early stages; inoperable cases often rendered operable by radium, which is employed only for the inoperable or advanced cases.

8. Rectum—no satisfactory treatment—if inoperable treat by radium and x-ray employing colotomy to avoid irritation.

9. Prostate—surgery and radium tubes in operable cases, otherwise radium needles by way of the perineum or cross-fire method by way of the rectum and urethra.

10. Bladder—Suprapubic operation to facilitate placing radium and for drainage.

11. Fundus of uterus—surgery if an early case; palliative treatment for all inoperable cases.

Much of the work of radiotherapy in the past has been experimental and empirical. Technique has often been exceedingly crude and too often used in the hands of men whose skill and training have not been such as to permit attainment of the best results, but

in present day therapy haphazard methods have no place. "Many disappointing results have followed the use of radium in quite unsuitable or hopeless cases."

As to end-results, he says: "A number of cases in which recurrence has shown itself within the five year period have cleared up and remained well. On the other hand, it is just at the five year limit that I would look out for manifestations of deep-seated secondary deposits, and I would place the critical period upon which statistics may be based, which would be of value, between five and ten years." This is applicable, he states, chiefly to carcinomata. "On the whole results are not good."

As to the future of radium, he says: "The possibilities of radium in the treatment of disease have not nearly been exhausted; in fact up to the present the technique has been more or less experimental. The experience of recent years brings forth two dominant facts. The potency of radium is now acknowledged by all competent workers; it is a most valuable adjunct to the surgeon and the x-ray therapist. Indispensable to both it is clear that a great future lies before it."

In his closing paragraphs he has this to add upon malignancies: "The question of radiations versus operation must now be discussed. In all cases, with perhaps one or two exceptions, there can be no doubt that the operation should be the first choice. In all cases where possible radium should be used at the operation, placing it in positions which are likely to contain residual cells."

Radiations in the Treatment of Cancer.

A lecture by Robert Knox, M. D., Lancet, 202:1121, June 10, 1922.

At the Cancer Hospital, London, operation is urged in all operable cancer cases and radiation is used subsequently. If operation is precluded then radiation is used. Border-line cases present the greatest difficulty of choice, and among these are mentioned carcinoma of the rectum, esophagus and cervix uteri.

Whether x-ray or radium is used matters very little "if the correct dose of the correct wave-length can be delivered at the site of the lesion." The "lethal" cancer dose cannot yet be accepted as proved and dosage must be determined in each individual case.

Blood examinations Dr. Knox regards as very important and states that they should be continued at regular intervals throughout treatment as well as just at the beginning. This is for guidance in treatment as well as for the sake of research.

The use of the higher voltages calls for protection of operator and patient from shock, over-exposure and inhalation of deleterious gases.

Full credit is granted German workers for their newer methods, but the impression prevalent in some sections of the medical world that German apparatus is superior to any other and requisite for the best results is a mistaken one. Both the French and the American apparatus is excellent, and sound work, in no way inferior to that of the Germans, has been done in France, England and America.

In Germany three or four anterior and as many posterior areas, each directed toward the area of disease are used. This admits of more penetrating radiation, administration of a long dose and the introduction of a comparatively accurate method for measuring dosage.

Dr. Knox uses a similar method, though on account of the limitation of current the shorter wave lengths cannot be used. A dose of the value of a full pastille dose measured on the distal side of the filter is sought. Twelve to thirty areas have been used—even as many as forty for deep-seated mediastinal lesions. As good results have been obtained in a number of cases as those claimed for the Erlangen method. As a rule x-ray has been supplemented by radium tubes.

A well known authority, Dr. Knox states, has suggested that all treatment along old lines should be discontinued because if any portion of a tumor receives 40 per cent of an erythema dose stimulation of the tumor growth will result. This Dr. Knox regards as an alarmist's view not upheld by experience. "What may be a stimulating dose for cancer cells is also apt to be a stimulating dose for normal tissue," strengthening its natural power in the fight against the malignancy. Full treatment by the Erlangen method holds the possibility of deleterious effects during the period of depression following treatment.

The mechanical details of the rotating tube mechanism used by Dr. Knox are described. Its advantages are (1) accuracy of application; (2) possibility of repeating at subsequent exposures the dose primarily given; (3) radiations can be varied in depth and latitude in order to influence all portions of the growth; the focus point can be fixed in front of, behind or at the center of the growth; (4) two or more doses can be directed to the center of the growth and a centrally situated growth can be approached from all aspects of the body and a maximum dose given to the area in which the tumor is situated.

In regard to pre-operative and post-operative treatment he says: "Radiation

tions can be used soon after operation, even at the time of operation, and—in cases where time allows before operation. * * * When an operation is arranged for as soon as diagnosis is made pre-operative treatment is not recommended, because if it is to be useful it must be of the intensive type, and this would reduce the patient's powers of resistance too severely."

The writer voices the fear that the newer methods in use at the Erlangen clinic may be used by incompetent radiologists, or may be used upon cases not properly selected and he bespeaks protection for the public. He states that contradiction of the sensational press reports of the results of the newer therapy is the duty of every radiotherapist.

The Mode of Radiation Upon Carcinoma. James Ewing, M. D., Am. J. Roentgenol., 9:331, June, 1922.

DIFFERENT organs of the body have different degrees of susceptibility to radiation, both with respect to structural integrity and functional disturbance, e. g., the skin is more resistant than the buccal mucosa, which in turn has greater resistance than the rectal mucosa. Bladder mucosa is notably susceptible, but brain tissue unexpectedly resistant. Normal lymphatic tissue may be surprisingly unaffected by radiation, which destroys neighboring malignant growths.

Age and associated pathological conditions must be taken into account in calculating dosage. Cardiac disease and anemia are specifically mentioned here.

Anything like an absolutely uniform standard of reaction of tissues, therefore, does not exist and dosage cannot be regulated by pure physics indispensable as is physics to radiotherapy.

In tumors the variation of reaction (which depends upon tumor structure) is particularly remarkable and is accounted a primary principle to be considered in treatment. Various types are discussed and the author says that "Unless the operator combines with his powerful physical machine a considerable knowledge of the pathological anatomy of tumors, he may have many surprises and disappointments and may sometimes do more harm than good."

He warns against "the common assumption that diminution in bulk is a reliable criterion of effective radiation or increase in bulk a proof of growth. Often reduction in bulk means merely absorption of fluids, slowing of secretion, draining of cysts, or closure of vessels with central necrosis, while peripheral cells remain intact.

"When a tumor swells following radiation it is generally due to hyper-

emia, swelling of tissue cells, and exudation of serum, blood and leukocytes." Mucinous degeneration, hemorrhages and bulky exudates or bacterial infection may produce the same effect of swelling. When all these sources of increased bulk are eliminated from the problem there is little ground left for the so-called stimulation of tumor growth.

In regard to the "killing dose" the writer says that the fact that a piece of extirpated cancer transplanted after raying, fails to grow is not proof that the dose used in raying it is a lethal dose for that type of cancer, since no account has been taken of the reaction of the living tissues *in situ*.

Several conditions under which the curative action of radium and roentgen rays have often been observed are discussed in arriving at the statement that cure does not depend upon a direct effect exclusively upon the tumor cells, but upon a peculiar reaction of the normal or invaded tissue cells which is as yet not understood. "We need a Virchow, a Waldeyer or a Weigert to solve these riddles."

Through study of the principles of the physiology, pathology and physics involved in radiotherapy is needed.

"Radiotherapy will progress more soundly if it follows the spirit of this era, avoids rigid procedures and blanket rules, and makes full use of the new knowledge which the development of this branch of medicine has both rendered necessary and placed at its disposal."

The Underlying Principles in the Radiotherapy of Malignant Tumors at the Surgical Clinic of Professor Schmieden of the University of Frankfurt. Hans Holfelder, M. D., Germany, Am. J. Roentgenol., 9:341, June, 1922.

AT the surgical congress held in April, 1921, at Berlin, one entire day was given over to the subject of x-ray treatment of surgical diseases. All the principal surgical clinics of Europe make extensive use of the x-ray.

With the exception of the subject of newer apparatus the following points are fully discussed in this paper:

(1) Rays of a sufficient quantity and power of penetration and a relatively constant output have resulted from the newer apparatus, while successful application is made possible by the development of a technique of measuring which employs the electro-scope and the iontoquantimeter.

(2) Uniform results depend upon every single cell in the whole area of growth receiving sufficient and equal dosage. Dosage must be within fixed limits and localized as nearly as pos-

sible to the seat of the disease. The whole dosage should be applied at one time and sufficient length of time elapse between radiations to permit the biological reaction to take place.

(3) Cooperation between physicist, radiologist and surgeon is necessary.

The conclusion sets forth the status (Sept., 1921) of clinical experience and the indications which determine treatment at the Frankfort clinic.

A Study of Rickets With Review of Recent Literature. Roy G. Giles, M. D., Am. J. Roentgenol., 9:360, June, 1922.

THE author's summary gives the main points of this paper and is as follows: "Rickets is a chronic acquired disease occurring most commonly during the first two years. Many views have been advanced to account for its occurrence, among these heredity, improper hygiene, infections of various natures, dietetic conditions, etc.

"All the tissues in the body may be affected in rickets, but the principal pathological lesions are seen in the osseous tissues. The cranial bones may show changes in shape and delayed ossification. Scoliosis and kyphosis may be detected in the spine. Dentition may be delayed. Enlargement of the costochondral junction, the so-called "rachitic rosary" manifests itself in the chest. The ribs are bent, porous, slender and have lost their normal inclination and parallel arrangement. The lungs are frequently small and atelectatic. Periostritis may be seen. Fractures may be single or multiple, and are often incomplete. The cartilaginous epiphyses are enlarged and frequently show on the roentgenogram. The diaphyseal end of the shaft spreads outward and its edges are irregular and jagged. The most important changes radiographically are seen in the epiphyseal line of the long bones and neighboring joints."

A Method for Roentgen Ray Demonstration of the Nasolacrimal Passageways. Don M. Campbell, M. D., L. R. C. S., (Edinb.) John M. Carter, A. M., M. D., Howard P. Doub, A. B., M. D., Am. J. Roentgenol., 9:381, June, 1922.

THIS type of examination gives valuable data in deciding what type of operation is to be performed and shows the point where dependent drainage may best be accomplished if an opening is to be made into the nose. Further valuable points are that in cases of partial obstruction it is easy to see what type of sac and duct is present and whether these are suitable for probing, or if an intra-nasal operation is necessary. Postoperative information of

value may be obtained. Whether the sac has been completely removed at the time of operation can be determined and the condition of the sinuses can be noted.

Value of Pyelography Before Undertaking Surgical Measures for the Relief of the More Obscure Types of Abdominal Pain. Vincent J. O'Connor, M. D., Illinois, M. J., 42:9, July, 1922.

THIS series of 28 cases, all referred because of chronicity of the complaint or obscurity of the trouble, are presented for the sake of emphasizing the value of routine urological study in diagnosis of obscure abdominal and pelvic disorders.

Too many operations are performed without sufficiently considering the possibilities of renal or ureteral pathology. In hydronephrosis an appendectomy is frequently performed before the real trouble is discovered. An extreme range of renal mobility is frequently the cause of right sided pain in adolescent females.

"A careful roentgenological and urological examination may establish the correct diagnosis in cases of obscure abdominal or pelvic pain or discomfort. Lesions of the upper urinary tract frequently exist without subjective or objective symptoms referable to the urinary tract. Ureter pyelography is frequently the only method by which an accurate diagnosis can be made. In cases where a suspected nephropathy or angulation of the ureter is suspected, this must be done with the patient both in the prone and erect positions."

Pyelography, Preliminary Report. Oswald S. Lowsley, M. D., Bost. M. & S. J., 186:873, June 29, 1922.

BOTH clinical experience and animal experimentation has lead the author to regard sodium iodide as most suitable for pyelographic work.

His technique is as follows: A preliminary examination is made with the cystoscope to determine if any abnormality is present. Next lead catheters are forced into the ureters to the kidney pelvis, if possible, and specimens preserved for various examinations. A kidney functional test is then made with phenolsulphonephthalein after which a picture of the upper ureter and kidney is made and also one of the lower ureter and bladder before any opaque substance is introduced.

"If stone in the ureter is suspected a double exposure plate is taken after the method of Kretschmer. By following this method a stone in the ureter will be in apposition to the lead catheter and then the x-ray tube is moved

laterally. If there is a stone in the ureter it will move with the catheter. If the shadow is cast by an object above or behind the ureter, it will not be in exact apposition to the catheter in the second picture, due to the change in the angle. Then the opaque material is introduced under gentle pressure until the patient states that a sense of fullness is felt in the back. This is done simultaneously on each side, and as soon as the sense of fullness above mentioned is noted the injection stops" and the same views already mentioned are taken.

The patient is then placed in a sitting posture with the middle of the plate at the crest of the ilium for the picture of the entire course of the ureter, a portion of the bladder, and the entire kidney. "Then the x-ray catheters are slowly withdrawn, sodium iodide being injected into the ureter during the process. When the ureter catheter has been withdrawn to a point just within the ureter orifice, the picture is taken, and in this way any abnormality in the contour of the ureter or the position of the kidney will be brought out. * * *

As soon as the picture is taken, the catheters are reintroduced a slight distance and the sodium iodide drained off. The instrument and catheters are then removed.

"Most of our patients complain of a considerable amount of pain for a few minutes, which may extend into several hours in certain cases, but only in seven cases have we had elevations of temperature above 100 since we have been using sodium iodide."

Pyelitis of Pregnancy. Fred M. Hodges, M. D., Am. J. Roentgenol., 9:352, June, 1922.

THIS paper reviews the literature and describes with the aid of plates seven cases of pyelitis of pregnancy occurring in the author's practice.

The following technique is said to have given almost perfect satisfaction: "The usual kidney cone; film—double screen; 40 ma.; five-inch gap; one-half to one and one-half seconds exposure. Only one side is examined at a time, the pelvis being slowly filled under fluoroscopic control. When the examination is made in this way, the patient is subjected to practically no discomfort or reaction, while a good pyelogram is obtained.

"This subject being still under investigation, any conclusions can only be tentative, but we believe the following summary is probably justified:

"(1) Pyelitis occurring during pregnancy is probably uniformly secondary to obstruction due to pressure on the ureter by the enlarging uterus. (2) Usually, due to the rotation of

the uterus to the right, the greatest pressure is exerted on the right side; but contrary to the usual assumption, the left side is in nearly every instance also affected, but to a lesser degree. (3) Be the source and route of the infection what it may, obstruction unquestionably exists, since in every instance immediate improvement followed evacuation of the uterus. (4) Measurements of the pelvic capacity usually give most of the desired information, but the evidence furnished by the pyelogram is conclusive, serial pyelograms giving a permanent record and graphic data which is of value in treatment and prognosis. (5) The true pathology of the condition is graphically demonstrated by the pyelogram and consists mainly of dilatation of the renal pelvis and dilatation and kinking of the ureter. The dilatation varies greatly. The lesser and medium grades will entirely recover, but the more severe grades with atony of the pelvic musculature only partially recover. (6) In women having borne children, a dilated pelvis and ureter, especially if the right side, may be a normal condition, the kidney forming normal urine and having a normal function. (7) The colon bacillus is usually the infecting organism, but others may occasionally be primary or engrafted on the colon infection. (8) The early diagnosis and treatment of pyelitis of pregnancy may be the means of avoiding serious if not irreparable damage to the kidney. (9) Pelvic drainage and lavage is of marked value adding little if any risk when properly done."

Pneumoperitoneum as an Aid in Obstetrical and Gynecological Diagnosis. Earl C. Sage, M. D., Nebraska M. J., 7:244, July, 1922.

THE work of Peterson and Rubin is reviewed by this author. Credit for the interpretation of x-ray findings and the proper positioning of the patient belongs to the late Dr. VanZwaluwenburg of Ann Arbor. The technique of giving gas (carbon dioxide) by the transuterine and the peritoneal route is described.

W. W. W.

A Pathognomic Sign of Intra-Uterine Death. Alfred Baker Spaulding, M. D., Surg. Gynec. & Obst., 34:254, June, 1922.

HISTORY, subjective symptoms and physical signs hitherto have been the only reliable diagnostic aids in ascertaining the death of the fetus, but the x-ray is coming to be recognized in this capacity.

During the recent months in the Women's Clinic of the Stanford University Hospital diagnoses of intra-

uterine death has been made by x-ray pictures of the fetal skull. It has been found that a typical overlapping of the skull bones, to a sometimes astonishing distance, is caused by the shrinkage of brain tissue in the dead fetus. This overlapping gives a very different picture than that produced by molding. The radius of curvature of the shrunken head becomes obviously smaller than that of the unchanged cranial bones, which retain almost the same size and shape. When overlapping together with this smaller radius of curvature occur, the conclusion that death has taken place is justifiable.

"In this series of 21 cases, 3 babies were dead and presented the typical findings; 18 were alive, of which 17 showed no changes in the x-ray picture of the fetal head and the suture lines. One baby showed marked overlapping of the skull bones, due to molding caused by a long first stage of labor, but in spite of this overlapping the skull bones showed no disproportion in relation to the bulk of the contents of the skull."

In 27 controls no overlapping of fetal skull bones nor diminution in size of skull contents could be seen.

From this study it is concluded that shrinkage of the skull contents with overlapping of the skull bones can be demonstrated with the x-ray and these are a pathognomic sign of intra-uterine death.

Roentgenography in Obstetrics. D. A. Horner, M. D., Surg. Gynec. & Obst., 35:67, July, 1922.

THE near future will witness a much wider use of x-ray in obstetrical practice. At present most obstetricians and roentgenologists fear its use upon the pregnant woman, but in the writer's opinion this fear is not justifiable if proper technique is observed; the short exposure then used cannot possibly effect either mother or child.

The writer differs with some others as to the stage at which the fetus may be distinguished. That positive diagnosis is possible at four months is a faulty conclusion in his opinion. Also he states that pneumoperitoneum reveals nothing that the educated finger does not reveal as well.

In later stages the x-ray shows the size and outlines of the fetus sufficiently to demonstrate position (not to be confused with presentation) and for this one exposure before the onset of labor is advised. Stereoscopic views at or just before term give a much clearer picture of the relation of the head to the pelvis and of the probabilities of difficulty in engagement.

In fetometry the writer has found the x-ray of great aid. As to pelvimetry

the writer states: "Many defects overlooked in external and internal examinations, e. g., marked contraction of the inlet, sacro-iliac disease, effects of old fractures, exostoses, callus formation following previous pubotomy, etc., can be perceived at a glance." Recognition of the finer points can be secured only by the x-ray, if at all, and then only after much experience in interpreting plates.

As a rule no note is taken of a woman's fitness to deliver a normal sized child. "The grossest deformities of her pelvis are not considered a detriment, even though her first labor will be fatal to her and her child, if not conducted by one specially prepared for all complications."

Intra-uterine death is indicated by overriding of the skull bones plus asymmetry of the head, and these signs are the only positive ones.

In case of the newborn, radiography leads to discovery of any injury not apparent otherwise.

Foreign bodies in the uterus have been incidentally detected by the x-ray a surprising number of times, in one case this discovery rendered a pregnancy safe which otherwise must have terminated unsuccessfully.

Failures After Gastro-Enterostomy Turned to Success by the Knowledge Furnished by X-ray Examination. A. Howard Pirie, M. D., Am. J. Roentgenol. 9:358, June, 1922.

IN cases where gastro-enterostomy has failed the author has searched in vain for a "vicious circle", but has discovered gastric delay in such cases with consequent vomiting as a means of disposal of stomach contents denied egress otherwise. It is quite possible that during vomiting bile may be forced up from the duodenum and expelled with the rest of the stomach contents, and mixing with these give rise to the assumption of the "vicious circle" so often mentioned in the literature.

There are three types of gastro-enterostomy openings. With the first type the food is allowed to escape the stomach almost immediately, but this need not necessarily be a bar to digestion. The second type permits a quick escape of a portion of the stomach contents at first and then gradually slows down the action. This type is also regarded as successful, but the third type causes serious trouble, as it permits of escape only at first entrance of food and then refuses further exit.

In examining these cases the first thirty seconds after the barium is swallowed (upon an empty stomach) yield the most useful information. The screen should be relied upon chiefly, the patient standing in the upright nostro-

anterior position. As soon as the barium is seen to pass the gastro-enterostomy opening and to enter the small intestine the patient is turned to the left lateral position so that the opening may be observed from the side.

Two cases taken from the author's practice are sufficiently described in the summary quoted below:

"(1) Vomiting continually for weeks after a gastro-enterostomy is usually due to retention of food in the stomach.

"(2) The gastric delay is due to the stoma being placed too far from the pyloric end.

"(3) Roentgen ray examination not only may disclose the cause, but provide the remedy.

"(4) First case of vomiting after every meal for three months following gastro-enterostomy cured by lying on left side after meals. Second similar case cured by lying on left side and rolling over a pillow on stomach."

DR. CHARLES MAYO in a paper upon the subject of chronic ulcer of the stomach and duodenum (Am. J. Surg., June, 1922) reports that Moynihan almost discredits laboratory tests in diagnosis of these lesions and prefers the roentgenologist's report to any other single finding when making his diagnoses of such ulcers.

High Tension Electric Shocks in Roentgenologic Practice. William F. Hemler, M. D., Am. J. Roentgenol., 9:365, June, 1922.

THE author concludes that the sources of high tension electric dangers are: "(1) Concrete floors in roentgen ray exposure rooms. (2) Metal tables, tubestands, fluoroscopic or switch cabinets within sparking distance of any one who might approach high tension currents, especially if such apparatus is or may become grounded. (3) Any grounded conductor within the room or under the floor unless guarded. This includes all low tension wires, cables to main or Coolidge transformers, foot switches, swinging cables of light switches, all wires of lighting system or wires for any purpose, and radiators, pipes and conduits. (4) Unguarded high tension lines and tube terminals."

Standardization of the Measurement of Tube Potential. Frank Rieber. Am. J. Roentgenol., 9:371, June, 1922.

THIS paper of ten pages is summarized briefly as follows: "A method of measuring significant tube potential is presented. The measurements taken indicate that the crest meter used responds to sustained peak potentials, but is unresponsive to surges and transients.

Spark gap readings when investigated in comparison with this instrument, show inconsistencies which are partially ascribed to surges. The sphere gap seems to be more sensitive to surges than the point gap, and, therefore, of less use in x-ray measurements. This statement applies for potentials up to 150 kv. Above this value the spheres seem to be the best available method, in spite of their sensitiveness to surges. Kilovolt meters cannot be relied upon unless calibrated against a number of point gap settings at the setting where used. They will then enable consistent return to that point. Disc rectifiers give greater surges and higher and more irregular gap readings for the same crest values than do arm rectifiers. All rectifiers give much more consistent results when closely adjusted."

Treatment of Suppurative Conditions of the Lungs. T. E. Carmody, M. D., New York M. J., 115:742, June 21, 1922.

AFTER discussing the etiology of lung suppurations, the author calls attention to the work of Stewart and Lynah, and makes the additional point of the abnormal distensibility and collapsibility of the affected bronchi. This condition is taken to have an important relation to the poor drainage and failure to resolve found in chronic cases.

Records of six cases are given in which bronchoscopy and aspiration of the pus were performed, using a motor driven pump. The results have been very encouraging.

Abstracter's Note—This paper is indirectly of interest to roentgenologists, since it follows up the work of Stewart and Lynah on the bronchoscopic investigation of lung abscesses, which was reported two or three years ago. Dr. Lynah, it is noted with great regret, has recently died.

V. W. W.

The Pathological Changes Produced in Those Rendered Insensible by Electric Shock and the Treatment of Such Cases. (Papers read before the Section of Electrotherapeutics of the Royal Society of Medicine, March 17th, 1922.) Arch. Radiol. & Electroth., 27:1, June, 1922.

THE introductory paper was read by T. Morison Legge, C.B.E., M.D., D.P.H., H.M. Medical Inspector of Factories. In this paper he says that Jellinek is the protagonist of the view that death immediately after electric shock is apparent and not real, while Jex-Blake in 1913 claimed that it is a real death and due to ventricular fibrillation. If the latter theory is the

true one then no amount of artificial respiration will restore life, but Jex-Blake advises long continued artificial respiration, desisting only upon rigor mortis.

Borruttau in 1918 disputed Jellinek's theory with an argument well backed by 340 fatal cases from the records of German factory inspectors. Borruttau claimed long continued artificial respiration to be useless in the absence of apparent signs of heart action. If Jellinek's view is right, then every medical man is duty bound to keep up artificial respiration for hours in cases of unconsciousness from electric shock. British statistics, although inadequate, support the view held by Borruttau.

Mr. Scott Ram (H. M. Electrical Inspector in the Factory Department of the Home Office) holds a questioning attitude. He calls particular attention to the fact that in cases of electrical shock accompanied by an immediate fall from a height of several feet recovery occurs without artificial respiration being necessary. He cites seven such cases which occurred in 1921; the height of the fall varied from 5½ to 35 feet, and although several of these had received very severe shocks, in only one was artificial respiration resorted to, and all recovered.

Most fatalities in his experience within the last number of years have come from alternating current, and in two-thirds of these the current was at low pressure. He severely censures the laxity that permits so-called medical electricians, as well as many other people, to install apparatus without knowledge of the dangers to be guarded against.

A Goodman Levy, M. D., M. R. C. P., (Physician to the City of London Hospital for Diseases of the Chest) states in his paper that experimental experience undoubtedly supports the view that death from electric shock is due to fibrillation of the ventricles. This generally proves fatal, but spontaneous recovery may occur in man just as often as it occurs in animals, though not later than two minutes from the onset of fibrillation. Apart from spontaneous recovery such cases are hopeless. It is an unfounded theory to hold that artificial respiration will arrest fibrillation. Immediate cardiac massage may restore heart action, but is impractical because it cannot be applied except in the immediate vicinity of the operating room. Single electric shocks employed within fifteen seconds of accident may be effective, but this also is not a practical method. However, heart and respira-

tion may be paralyzed together, and in anticipation of this condition and of cardiac recovery it is well to proceed to artificial respiration immediately, though its value has been greatly overrated in the writer's opinion.

Professor J. A. MacWilliam, M. D., F. R. S. (Regius Professor of Physiology, University of Aberdeen) adds to the symposium, saying that the modes of immediate death from electric shock are three, namely, (1) arrest of respiration from paralysis of the respiratory center while the heart continues to beat, (2) overthrow of heart action by development of fibrillation, ventricular fibrillation being the determining cause of death, (3) combination of the first two.

There is a relative susceptibility of the ventricles to fibrillation from electrical stimulation which varies greatly in different animals and even in the same animal species and, presumably, in man as well. If the period of ventricular fibrillation is more than a very brief one the central nervous system will probably suffer irretrievable damage, but artificial respiration should be tried in all cases. (To be concluded.)

X-ray Dosage in Treatment and Radiography. By William Daniel Witherbee, M. D., in Charge of Radiotherapy, Presbyterian Hospital, New York, and John Remer, M. D., in Charge of Radiotherapy, New York Hospital. Cloth, 16 mo, 87 pp., five illustrations; New York: Macmillan Company, 1922. \$1.75.

THIS book deals with the methods of dosage used for the past four years by these authors in both their private and clinical practices. Unfiltered and filtered (A1) dosage are treated of, but no experience is claimed in the high voltages above ten inches. The work, as is stated in the preface, is especially applicable and useful in determining the amount of each exposure in radiographic work. Most of the work has been rewritten from articles already published in various medical journals.

The eight chapters deal, respectively, with unfiltered x-ray dosage; x-ray burns in radiography; filtered x-ray dosage; principles of x-ray burns; cause of x-ray burns; treatment of focal infection of the throat by x-ray compared with surgical removal of tonsils and adenoids; x-ray treatment of skin diseases; x-ray treatment of uterine fibromata, menorrhagia, leukemia and Hodgkin's disease.

This little book is a handy and useful compendium of the author's technique as outlined above.

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Bone Diseases, Osteoporosis or Lipomasia from Fixation and Non-Use

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I HAVE but three cases to report. However, as the first two were referred to me with a possible diagnosis of sarcoma, and the third with a diagnosis of tuberculosis, and as the first two patients have completely recovered after removal of the fixating dressing and forced function, and the third is rapidly showing improvement now only two weeks after the removal of the plaster cast, I feel that attention should be called to this group from the standpoint of differential diagnosis.

Case 1—(Pathol. No. 15895)—The x-ray plates in this case were sent to me by Dr. R. L. Ramey of El Paso, Texas, in 1914, eight years ago. These plates have been lost, but were practically identical with those shown in Figs. 1 and 2 from the second case.

Clinical History: Dr. Ramey wrote that the patient, an adult female, had been confined to her home for one year and had not even been out of the house for months. The pain in the joint was looked upon as rheumatic and she had been given antirheumatic medicine and Bier's hyperemia without improvement. After this long period of almost complete lack of function, Dr. Ramey sent me the x-ray plates, and he was most impressed with the light shadows in the internal condyle. The patient remembered a distinct contusion of the knee nine months before the onset of pain. Later Dr. Ramey reported that the Wassermann was negative, the urine contained no Bence-Jones bodies; now and then the temperature rose to 100, and the Von Pirquet test gave a reaction. Then, on further questioning, the patient remembered that she had had trouble with this knee years before.

X-ray Report: I wrote Dr. Ramey as follows: "The x-ray picture is one of osteoporosis. This bone absorption giving the mottled lighter areas is present in the lower end of the femur, the upper end of the tibia, the fibula and the patella. There is no evidence of malignant disease. These bone changes are common near joints when, because of arthritis, the limb is not used." At that time I also wrote that tuberculosis

might give such a picture, but as a rule we should be able to see, in addition to the diffuse osteoporosis, definite foci of bone destruction, due to the tubercular granulation tissue.

Today I would write that I have never seen tuberculosis give this picture. It is the usual picture observed in arthritis when there is fixation treatment and non-use.

Second X-ray: Five months later other x-ray pictures were sent. The patient in the meantime had improved under forced diet, massage and moderate use. I could not see any difference in these pictures. The patient gradually improved.

Result, May, 1922: The patient writes that her knee gives her practically no trouble and that she is using it in a normal way.

Case 2—(Pathol. No. 23881)—When I saw the plates in this case (Figs. 1 and 2) and examined the patient, referred to me by Dr. K. H. Beall, of Fort Worth, Texas, in December, 1918, I immediately remembered Dr. Ramey's case and compared the x-ray pictures which, for practical purposes, were identical. In the Journal of Radiology for March, 1920, Figure 22, I reproduced these pictures to illustrate the bone changes which may follow traumatic arthritis when fixation or non-use are continued too long, and described how this lesion could be differentiated from other types of benign and malignant lesions.

Clinical History: This patient, a white male, aged 46, in perfect health, received a severe injury to the left knee thirteen months ago. He stepped through a hole in the floor. The upper end of the tibia caught and he fell forward, twisting the knee. There was, therefore, both a contusion and a sprain, and he presented at once the typical picture of traumatic arthritis with effusion. An immediate x-ray showed no fracture, nor evidence of a pre-existing lesion. He has never recovered, although there have been periods of improvement, made worse by secondary slight sprains. The limb has been in a

plaster cast, or the patient has walked on crutches ever since.

Examination: Nothing on inspection. Palpation showed no particular infiltration or thickening of tissues and no fluid in the joint. The knee was almost fixed in extension. There was some slight active and passive motion. This gave pain and joint crepitation. All other examinations were negative.

Although I was quite certain that the entire condition was the result of injury and non-use, the patient seemed unwilling to start active motion and massage until more was done to exclude a possible tuberculous lesion. Under novocain the lower end of the femur was explored through the external condyle; the cortical bone was thin, the cancellous bone porous with much fat, and here and there was blood pigment.

Microscopic Sections: The synovial membrane showed thickening with chronic inflammatory tissue. The bone presented the picture of osteoporosis; between the bone lamellae there was chiefly fat, here and there blood pigment, here and there round cells and some osteoblasts, no giant cells. The only evidence of the old trauma was the remaining blood pigment.

Treatment: I instructed the patient to use the limb, to gradually increase the weight-bearing and the function, to soak it twice a day in a hot bath, and to give massage.

Result: Improvement began at once. It was some time before he discarded the crutches and took to a cane.

X-ray One Year Later: The architecture is not yet restored to normal, but the bone is distinctly less porous than one year ago. The patient now walks with a cane. There is no limp, and pain and tenderness have almost disappeared. Result in 1922, practically well.

Case 3—(Pathol. No. 31024)—I saw this patient with Dr. Bombard in Burlington, Vermont, August 20, 1922. This healthy looking man aged 42, was sitting in a chair with the left limb in plaster and resting on a chair. This practically describes his condi-



Figs. 1 and 2—Case 2—Pathol. No. 23881—Diffuse osteoporosis (lipomastia). Bones of knee joint thirteen months after contusion with non-use during this interval.



Fig. 3—Case 3—Pathol. No. 31024—Lateral view of knee joint seven months after a sprain followed by fixation and non-use. Marked osteoporosis of all bones.

tion with intervals of improvement since a sprain of this joint seven months before. Dr. Bombard informed me that two consultants had looked upon the x-ray plates as rather indicative of either tuberculosis or some marked infectious arthritis. You will observe from Figures 3 and 4, the x-rays of the knee joint, that they are practically identical with those in Case 2; perhaps the osteoporosis is more marked. It involves all the bones in the neighborhood of the joint and is present to a lesser degree in the shaft, particularly marked in the patella.

A few days later we took an x-ray of the ankle on the same side in which there had been no clinical symptoms, but the same fixation, and we found the same x-ray evidence of osteoporosis.

In the x-ray pictures reproduced here, and in Case 1, there is no evidence of bone expansion, there is no new periosteal bone formation, simply the normal architecture of the bone is changed by a diffuse, irregular bone absorption.

The only condition that might simulate this would be multiple myeloma and metastatic carcinoma. But when I compare these plates with the x-ray plates of the latter two diseases, I have not a single picture in which the three bones of the knee are involved, or the diffuse involvement in the region of the ankle and foot. When I compare a single bone of the x-ray pictures of these three cases with x-ray pictures of multiple myeloma or metastatic carcinoma, I find somewhat similar pictures in metastatic carcinoma in the pelvis, especially in the ilium, but as a rule in metastatic carcinoma and in multiple myeloma, the lighter shadows are larger.

In the first two cases we can exclude multiple myeloma and metastatic carcinoma; in the second, I think, the evidence excludes tuberculosis, and I am inclined to the view that in the third case the bone lesions are best explained as osteoporosis from non-use.

The examination in this case was identical with the second case. There was practically no motion in the joint, the patella was movable.

Treatment: This was the same as in Case 2, and there was rapid improvement within one week.

CONCLUSIONS

These three cases illustrate the importance of familiarizing ourselves with the x-ray changes in bone following non-use consequent upon injury or disease. Years ago Wolff established the fact that the normal architecture of bone and the growth of bone depended upon function, whether that be weight-bearing or not. If the lower jaw is



Fig. 4—Case 3—Pathol. No. 31024—Anteroposterior view of knee joint showing osteoporosis of all bones. (See Fig. 3 and 4.)

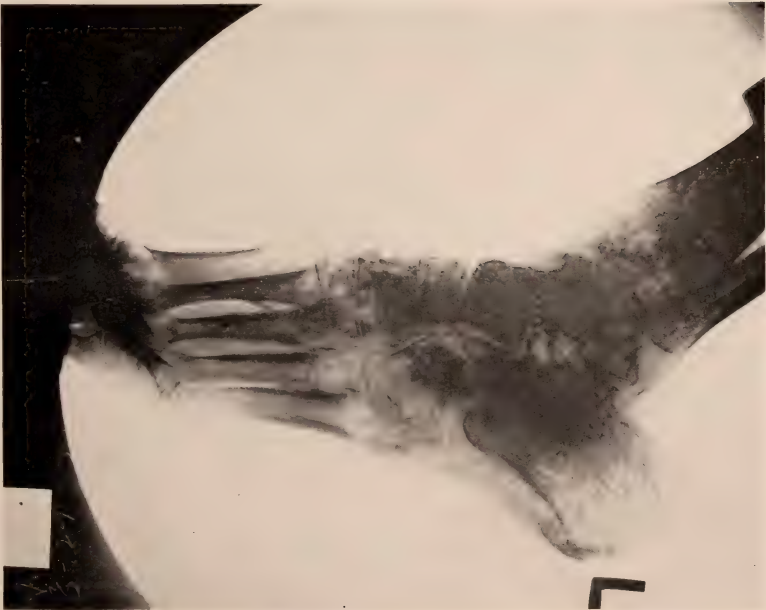


Fig. 5—Case 3—Pathol. No. 31024—X-ray lateral view of ankle, showing the same changes of osteoporosis present in the knee. (See Figs. 3 and 4.)

ankylosed in a child it does not grow, and the x-rays show osteoporosis.

As an example of the softening of bone due to non-use I remember some ten years ago exploring an ununited fracture of the femur due to overriding. Excessive callus was revealed in the x-ray plate and upon palpation. The patient had been in plaster for over nine months and had borne no weight on the limb. When I exposed the fracture the callus and the shaft of the bone itself were as soft as cheese and could be cut with the knife. The wound was closed. The patient was made to walk on crutches bearing weight on the limb for three months, and during this time massage was given. At the second operation the structure of the bone had been restored to normal and a saw had to be employed to cut it.

Some twenty-five years ago I remember assisting at a resection of a knee-joint upon diagnosis of tuberculosis in an apparently healthy woman of 65. The joint trouble had followed an injury and as it did not improve from rest in bed and fixation, it was diagnosed tuberculosis. At the operation no evidence of tuberculosis of the joint was found, and the bone was soft, the cortex thin. I still have the tissue and the sections of this case, and no evidence of tuberculosis can be found, only lipomasia. I remember distinctly how slowly bony union followed the resection. It was not until we had fixed the limb in an old Thomas' splint and got the patient up on crutches and encouraged weight-bearing, that solid bony union took place. This patient

lived to a ripe old age with the discomfort of a stiff knee. Today I am of the opinion that she belongs in this group, and I am rather inclined to the view, when we come to restudy our old cases of resection of joints on the diagnosis of tuberculosis, there will be found a few more of this type.

In the December number of *Progressive Medicine* from 1899 to 1918, in reviewing the literature on fractures, I constantly called attention to those authors who wisely urged ambulant treatment and the maintenance of joint function and weight-bearing.

These cases also show the importance of x-ray of bones other than those immediately involved. In cases of the kind discussed here all the bones of the extremity in fixation should be x-rayed.



Cancer--Its Character and Causes*

LEO LOEB, M. D.

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THANKS to the application of many investigators the work accomplished in the study of cancer within the last twenty years has been very great indeed. This period may justly be called the experimental epoch in this study and today we begin to see that we have learned perhaps the most essential facts about the causes and character of cancer although many mysteries still remain. This is not peculiar to cancer alone, but applies to many other diseases as well.

In the short time at my disposal I can only attempt a very brief discussion of what I consider the most important conclusions arrived at regarding the character and causes of cancer. You will forbear with me if I shall omit a detailed consideration of the underlying facts and of much else that might be stated if the time permitted. I shall, however, make a special effort to indicate where uncertainties still exist, and to indicate also where is the actual borderline of our knowledge.

Cancer cells are cells which originally were normal cells of an embryonal or adult organism and which have become transformed into abnormal cells under the influence of various kinds of internal and external conditions. These cells act as if they were constantly stimulated to multiply and to move. Increased intensity of multiplication and of movement are in themselves not rarely found in other conditions than cancer. Indeed, it is an interesting fact that in general a stimulus which has the tendency to cause an increase in one of these two effects, multiplication and movement, likewise causes an increase in the other, although different kinds of cells show a varying degree of ability to respond with either multiplication or movement. But it is this increased tendency to multiply and move which causes the essential symptoms of the disease, which determines the recurrences, the metastases, the pressure effects and ulceration. There remain possibly some chemical effects which are at present not yet well understood and which may lead to an early cachexia.

Now, increased cell multiplication and increased motor activity as such are not peculiar to cancer; we find them in various other conditions, such as

embryonic development, regenerative processes, in compensatory hypertrophy and what in general we may call correlative growth, in the formation of normal placenta and of the experimental placentomata. Even in regenerative processes an invasion of the blood vessels by the multiplying cells may occur. But cancer differs from these processes in one or two essential respects. In cancer this increase in the multiplying and motor reactions is permanent; in the other conditions it is limited, transitory, and the reaction leads to the elimination of the cause of the stimulus which induced the changes; in cancer the reaction does not have such a limitation. The stimulus acts unceasingly and unendingly; and while in other conditions the stimulus, being limited and regulated in its varying intensity and in the way it affects various tissues, leads to an orderly, well determined reaction which remains in bounds and serves the organism, in cancer the stimulus affects one or more tissues disproportionately and irregularly; thus the normal interaction with neighboring tissues is disturbed and the growth becomes irregular. This irregular, unending increase in multiplying and motor activity is the essential characteristic of cancer.

It is very probable that the majority of the other characteristics of cancer are merely secondary to this primary condition. This applies especially to the abnormalities in morphological properties, the abnormal and varying size and general conditions of cells and nuclei, the relative lack of functional activity of the cells and the relative independence of the cancer cells from the normal regulative influence of a neural character or of some hormone. Quite generally in biology we find an antagonism between specific function of cells on the one hand, and multiplication and motor activity on the other. Thus what is often called the autonomy of cancer cells may be merely a secondary phenomenon. As to the irregularities found in mitotic nuclear division in cancer, it remains still to be determined how far this is likewise merely a secondary effect and how far it is primary. The preponderance of the evidence seems to point to the conclusion that it also is a secondary phenomenon.

We may then conclude that cancer cells are transformed normal cells functioning abnormally under the influence of a change which occurred as the result of certain conditions which we shall

discuss presently, after we have briefly referred to some interesting properties of cancer cells and inquired whether they are distinctive of cancer cells or characteristics of tissue cells in general. To name a few of the more important characteristics:

(1) Continued transplantation of cancer cells has shown that they are potentially immortal. But instead of assuming that they therein differ from ordinary tissue cells, we must on the contrary conclude that, inasmuch as the majority of tissue cells may be converted into cancer cells, ordinary tissue cells as such are potentially immortal. This necessary conclusion I expressed in accordance with our experimental results more than twenty years ago, and recent experiments with tissue cultures by Carrel are confirmatory of this conclusion. It is well to emphasize that cancer cells differ from tissue cells not in being to a less degree potentially immortal, but in being continually dividing and moving with greater intensity.

(2) The growth of cancer cells can be experimentally increased and decreased. The same holds good in the case of normal tissue cells and there exists a state intermediate between cell death and active vigorous life.

(3) Cancer cells can be actively immunized against certain agencies tending to depress their proliferative activity and this property is transmitted through somatic heredity to succeeding cell generations. While I am not aware that this has been demonstrated in the case of tissue cells, I think it very probable that it, too, is not peculiar to cancer cells, but is a property of tissues in general.

(4) It has been maintained by Bashford that rhythms in growth exist in cancer tissue. This certainly does not apply to all cancer tissue; if such rhythms should exist, they would be comparable to the rhythms observed in the life of certain unicellular organisms.

We see, then, that so far there is no reason to attribute any peculiar property to cancer cells except the one already mentioned, namely, the increase in proliferative and motor energy leading to disorganized growth, lacking those regulative nervous influences, or those of some hormone, which are active in the case of many normal, less actively growing tissues. This change is potentially continuous and not temporary, as in related conditions to which we referred.

*—Read at the Midyear Meeting of The Radiological Society of North America, St. Louis, May 19, 1922.

How does this change come about? Under what conditions do normal cells become transformed into cancer cells? We have stated above that cancer, on the one hand, and regenerative, correlative, embryonic and placentomatous growth, on the other hand, are similar, inasmuch as in all these conditions there is an increase in proliferative, and also in motor activity under certain conditions, but that while in the former the change is continuous, in the latter it is transitory.

Now, it is an interesting fact that all those states which cause such a transitory growth may under certain conditions produce that change in the cells which makes them continue in this increased activity, although the direct cause of the increased activity has apparently ceased to exist; in other words, they convert them into cancer cells. Thus we find that all conditions which lead to long continued regeneration or related states, which produce, through mechanical, physical or chemical stimulation, cell proliferation and which continue over a relatively long period of time, may cause this transformation. Such stimuli may be physical, leading to continuous regenerative growth, and this is a frequent source of cancer especially of the mouth, cheek or skin, probably also of the stomach and uterus. The cancers caused by roentgen rays belong to this category. Or the stimulus may be chemical. Of this kind are probably the sarcomata and carcinomata produced in the liver or stomach of rats through the presence of parasitic worms. In other cases, as in the cancers caused by the use of tar or aniline dyes, it is difficult to decide how much of the stimulative effect is to be attributed to physical and how much to chemical stimulation.

Through application of such stimuli it has been possible, especially in the hands of Fibiger, Yamagiwa and Tsutsui, to produce cancer at will in rats, rabbits and mice in a very large number of animals. Fibiger produced cancer of the stomach in both rats and mice through feeding the nematode *Spiroptera neoplastica* (*Gongylonema neoplasticum*). Yamagiwa and Ishikawa, through the long continued application of tar, produced cancer of the skin in rabbits, and the same results were obtained with greater ease in mice by Tsutsui, Fibiger, Murray and Woglom, Bloch and Dreifuss, Bierich and Moeller. Yamagiwa and his collaborators through long continued injection of tar into the breast of a rabbit produced a sarcoma of the mammary gland, and in chickens in several cases he produced carcinoma of the oviduct through injection of a solution of scarlet red in oil. By various steps a trans-

formation of normal tissue into cancer tissue occurs. The cestode sarcomata in the liver of rats which originate in the capsule around the parasite were observed not only in spontaneously infected animals, but also produced at will in a large percentage of rats by Bullock and Curtiss by feeding these animals the parasites. Marie and his collaborators succeeded through the long continued application of roentgen rays in experimentally producing sarcomata in rats. In general, we can say that carcinoma and sarcoma are both produced by the same kind of stimuli, and that their mode of origin is of a similar character. To this class of cancers, which are produced through the local effect of chemical stimulus, belong probably also the contact combination cancers, carcinomata or sarcomata, produced in normal tissues through stimuli emanating from a neighboring cancer. They have their analogy in normal tissue in the effect exerted, for instance, by the ovum on the granulosa of the follicle and thus on the whole ovary, in the effect exerted by the lens of the eye on the overlying ectoderm, and similar other correlations.

The stimuli which we have considered so far are of local origin. There are in addition other stimuli of a chemical nature which act at a distance. In normal tissues they cause the correlative growth of compensatory hypertrophy, which also includes the hormonal growth as exemplified in the cyclic proliferative changes in mammary gland and uterus, in the development of deciduomata and placentomata, although other factors have to cooperate in the latter kind of growth processes. The same kind of stimuli are also concerned in the origin of cancer. One of the best studied varieties of cancer, the cancer of the breast in mice, originates only with the cooperation of an internal secretion emanating from the ovary and reaching the mammary gland. Early extirpation of the ovary in a sexually matured mouse prevents the development of mammary cancer at a later date. In this case a chemical stimulus originating in a distant organ takes the place of a chemical or physical contact stimulus.

During embryonal development the proliferative and motor activity of cells is at a higher level than in the adult organism. We find accordingly an important class of cancers originating in embryonic tissues. These cancers find their benign prototype in embryomata developing parthenogenetically from ova, and in displaced tissues and excess formations due to a localized unequal slowing down of embryonic development or other embryonic interferences. These pathological structures

representing tissues with a potentially heightened growth energy, form a favorable soil for the development of cancers.

We see, then, that a condition, either actual or potential, of intensified growth brought about through the action of special stimuli or through the normal state of the tissues is one of the important factors in the origin of cancer. Tissues which normally are no longer able to proliferate do not produce cancers. On the other hand, organisms which have a very extensive power to respond with regulative growth processes to various growth stimuli show organ formation or agamic reproduction rather than cancer. Thus I would interpret the fact that in certain classes of invertebrates cancerous processes have not yet been observed to occur.

But the conditions which we mentioned as the causes of cancer are as such often impotent to cause it, if they act as separate entities. Very often they act in association with an hereditary constitutional factor, which determines the readiness with which the other factors which we mentioned are able to cause the cancerous transformation. This hereditary condition not only very often determines, whether or not cancer shall appear, but also as our investigations showed, at what age cancer shall appear, and, according to the important investigations of Miss Slye, which organs shall show this cancerous transformation. Statistical studies and observations of Tyzzer, Murray and myself made very probable the existence of this hereditary factor. In conjunction with Miss Lathrop we showed subsequently that many families and strains of mice kept under identical conditions differ greatly in their cancer rate, and that this characteristic cancer rate is transmitted hereditarily through successive generations. Miss Slye obtained similar results and greatly extended this field of investigation. I do not need to enter into a detailed discussion of this factor, inasmuch as it will be considered separately by Miss Slye. I may only say that while there seems to be some difference in the interpretation of the phenomena of heredity between Miss Slye and ourselves, in the most essential aspects we are all agreed. Differences which may exist are due to the complexity of the factors which enter into these investigations; they concern not the fact of inheritance, but the mode of inheritance, whether cancer is dependent upon the presence of a single recessive factor, or whether it is due, as appears more probable to us, to the action of multiple factors.

I wish, however, to refer to the relation which exists between the external and the inner, the constitutional, fac-

tors. There seems to be a quantitative relation between these two sets of factors. The constitutional factors vary in quantity in different families; some have in the average of the individuals a maximum quantity, other almost none. The majority have various intermediate quantities. Now, with a given stimulus of a low or medium intensity the presence of the constitutional factor seems to be a prerequisite for the development of cancer. On the other hand, the stronger the stimulus becomes, the greater are the chances that cancer will develop even without the presence of a large constitutional quantity. The constitutional factor may perhaps be dispensed with entirely.

Inasmuch as this interaction between stimulating factors and hereditary predisposition is of very great importance, and so far has hardly received any consideration, it might be well to add a few words concerning this point. The investigations which we mentioned above prove that a combination of two factors, namely, stimulation of cells through external or internal factors represents the essential cause of cancer. This statement is, however, not sufficient as it stands. In many cases these two sets of factors cooperate in the production of cancers; but there is sufficient reason for assuming that each of these factors separately is able to be a sufficient cause. The evidence on hand proves conclusively that external stimulation alone is able to produce cancer even without the presence of an hereditary predisposition. A very large number, perhaps the majority of the early roentgen operators who exposed their skin to the constant stimulative action of the rays, without using the necessary precaution, have succumbed to cancer of the skin. It is extremely improbable that in all of those cases there existed a special predisposition to cancer. If we turn to experimental tar cancer, I believe the results so far obtained justify the statement that it is possible to produce this kind of cancer in the large majority of mice subjected to the action of this substance. The percentage of cancers thus experimentally produced is extremely large in strains of mice so divergent as those used by Tsutsui in Japan, by Fibiger and Bang in Copenhagen, by Bierich and Moeller in Hamburg, by Murray and Woglom in England, and especially by Bloch and Dreifuss in Switzerland. We know that spontaneous cancer of the skin is extremely rare in mice; it is out of the question that in such a large variety of mice everywhere a special predisposition should have been in existence. The experiments of Fibiger and of Bullock and Curtiss, in which parasitic worms caused cancer in rats, while they point

to a species, race or strain predisposition, likewise necessitate the interpretation that a sufficiently strong and long continued stimulus is in itself liable to produce cancer in a very large number of individuals having no special predisposition to acquire cancer of the stomach or liver. Through injection of tar into the mammary gland of a rabbit during a period of almost two years Yamagiwa, Suzuki and Murayama produced a sarcoma which was transplantable. Spontaneous sarcoma has not been observed so far in rabbits and it is extremely improbable that we had, in this case, to deal with a specific predisposition to sarcoma of the mammary gland.

We may safely conclude that a proper stimulus, if it acts over a sufficiently long period of time with the adequate intensity on animal tissues which are able to respond to single stimuli with regenerative growth processes, will produce cancer, carcinoma or sarcoma, even in the absence of an hereditary predisposition. But I believe the evidence on hand justifies also the converse statement, namely: If in an individual a sufficient amount of predisposition exists, cancer can be produced without the action of an extraneous stimulation. If we consider mammary cancer in mice, our own experiments, as well as those of Miss Slye, have shown that this cancer is transmitted in mice in families and strains on the whole in fixed percentages which are characteristic of each family and strain, and which are within very wide limits independent of the environment in which the animals live. Now, even in these cases our experiments showed that a stimulating factor is at work; but it is a factor which is acting within the animal organism and which is therefore hidden and can only be demonstrated through special experimental procedures. In the case of this stimulus it is only possible to diminish its strength in a graded manner, and correspondingly, quantitatively to diminish the incidence of cancer, and experimentally to alter the typical cancer rate; but it is not possible to increase the strength of this stimulating factor. We cannot increase the activity of the ovary, of the corpus luteum over a longer period of time, nor can we regularly accelerate ovulation. If that were possible we should have good reason to expect an increase in the incidence of mammary cancer in mice, with the same definiteness as it has been found in the case of cancer of the skin.

In the case of cancer of the breast the hidden internal stimulus forms a natural part in the functioning of the organism; yet it is not a prerequisite for the life of this organism and can be experimentally diminished or entirely

eliminated. Nor is it conceivable that in other cases certain internal functions, which cannot be experimentally eliminated and which are necessary for our life, play the part which the functioning of the ovary plays in the case of mammary cancer. Then we would again have superimposed upon a specific hereditary predisposition a stimulus, but it would be a stimulus altogether hidden and not recognized as such and it would hardly be accessible to an experimental analysis. In this case the cancer would be the result of an hereditary predisposition in which a stimulus is not implicated in the etiology. For instance, certain hereditary tumor formations, which occur in *Drosophila* apparently with the same fixity as hereditarily transmitted normal characteristics, and the hereditary transmission of neurofibroma, gliosarcoma and certain other tumors in man, very strongly suggest the existence of this third type of combination in the etiology of cancer.

There still remains to be considered one important class of cancers, a class differing in several respects from the ordinary kinds of cancer and in which research has established the probability that a microorganism is the stimulus which directly causes the increase in growth and motor activity.

When we began our experiments in the propagation of tumors and transferred cancer to successive generations of animals by inoculating them with small particles of cancerous tissue, we not only intended to analyze the properties of cancer cells and the reaction of the animal body to the inoculated cells, but we also had hoped that we might be able to determine whether or not an agent could be separated from the cancer cell with which it would be possible to transfer the disease. We could indeed produce cancer by injecting material filtered through filter paper, by subjecting it to the influence of glycerine or certain other substances but we found that whenever our experiments had a positive result, living cancer cells as such had been transferred. Filtration through Berkefeld filters gave negative results. We concluded, therefore, that in the typical kinds of mammalian cancer it was not possible to separate an agent distinct from cancer cells. We found no indication that a microorganism was etiologically implicated. In accordance with this conclusion is the result of immunization experiments. Whenever immunization is accomplished, it merely consists in an immunity against the cancer cells. In principle, it therefore does not differ from the immunity against ordinary tissue cells.

While these experiments do not point to the etiological significance of a microorganism in the typical mammalian can-

cer, they are indeed a study in the etiology of tumors and I believe that the results obtained, although negative in character, are a contribution to the causative analysis of cancer.

The identical mode of experimentation extended to another kind of cancer, namely, certain sarcomata in fowl, on the other hand led to positive results, and Peyton Rous succeeded in finding some fundamental facts in this field. By means of filtration through filters impermeable to cancer cells proper, by drying out, an agent could be separated, the injection of which in other fowl caused the development of the typical sarcoma. In this respect both the sarcoma of fowl and the other cancers so far investigated differ. But they also seem to differ in certain other ways. In chicken sarcoma a passive immunity can be produced through the injection of material free from living cells. In mammalian cancer this has been found impossible to accomplish. Furthermore, according to Peyton, the injection of chicken sarcoma material into the muscle tissue of fowl causes a tumor of a different kind to originate, namely, a tumor consisting of muscle cells. In the typical mammalian cancer such an infection does not occur, except, if through the action of growing cancer cells extending over a certain period of time, a neighboring tissue of a different kind is stimulated to become cancerous. It is, however, not impossible that certain kinds of mammalian cancer are also due to a separable agent similar to the agent of chicken sarcoma. Thus, in sarcoma of the ear of hares, results have been obtained which are comparable with those found in the immunization of birds against chicken sarcoma.

Some observations might even be interpreted as favoring a similar conclusion in the case of the typical mammalian cancers. We know that mechanical irritation is one of the causes of cancer. Now, it has been found, in fowl, that mechanical injury of the tissue of the animal serving as host favors a development of sarcoma after injection of the cell free material containing the agent. But in this case we have to deal with a single trauma which evidently acts by removing a layer of endothelial cells which effectively separate the agent from the cells which otherwise it could not invade successfully. We might also refer to certain observations where injection of human cancer material into various species of animal caused peculiar new formations, which differed in character from the tumors used for inoculation.

We might further cite the experiments to which we have already referred in which contact with one kind of

tumor incited normal neighboring tissue of a different kind to become cancerous. But we have seen that these observations are accessible to a different interpretation.

Taking all those facts together it is most probable that in certain cancers an agent separable from cells, probably a microorganism, supplies the constant source of energy which stimulates the cells to endlessly increased growth. In the majority of cases the combination of constitutional hereditary factors and stimulation of a variable character, extending over a certain period of time, causes a perpetual increase in the propagating and motor activity of cells characteristic of cancer. If later it should be found that even here microorganisms are implicated (an outcome which I consider not very probable) we would have to deal with a micro-organism present everywhere and in the real sense therefore not the specific cause of cancer. According to my judgment, the specific etiological factors in cancer have been established. They are certain definite constitutional factors acting together with physical and chemical stimulation, and among the latter we must include certain internal secretions.

Thus, we are now able not only to produce cancer experimentally at will, in any desired number, but we can also predict the number of cancers that will occur in certain families of animals, and moreover, we are able to reduce this number at will, experimentally, to any desired degree, or to prevent the appearance of these cancers altogether. Factors, which increase the growth energy of normal cells or tissues temporarily, if acting with a certain intensity over a long period of time, tend to raise the level of the growth energy and motor activity of the cells permanently, and thus to produce cancer.

One question still remains to be answered, namely, how do stimuli of various kinds lead to an increase in the multiplying and motor activity of the cells which in certain cases may be perpetual, although the stimulus has ceased to act? How can such an acquired characteristic become hereditary? These questions we cannot answer at present, any more than we can state what is the peculiar constitution of living matter which endows each kind of cell with a particular energy enabling and stimulating it to propagate, or to move, with a definite fixed intensity.

The further problems as to the causes of cancer merge more and more into the questions pertaining to cell multiplication in general. The further we penetrate, the more the study of cancer becomes a branch of the biology of cells and tissues. And the interaction be-

tween the study of cancer as a branch of biology and the other biological sciences is mutual. In the past the study of cancer has revealed fundamental properties of the normal cells and tissues and thus has materially contributed to general biology. In the future we may have to rely more on the contributions of sister sciences in biology in order to clear up the remaining problems of the origin of cancer.

DISCUSSION

MAUD SLYE, PH. D., (*Chicago*): As my seat was so far at the rear I was unable to hear the paper presented by Dr. Loeb sufficiently well to be able to discuss it. One point came through, however, about which I might make a statement. That point was the inference which Dr. Loeb drew, that heredity might not be a universal factor in cancer occurrence, based upon the results in producing artificial tumors. In none of this work in artificial production of tumors has there been any previous analysis of stock in order to find out the natural tumor potentiality of the animals used. All of this work, therefore, leaves us uncertain of what part of the results was produced by nature, and what was the actual experimental residuum. Therefore, much of this artificial production of tumors will need to be tried over on biologically analyzed stock, whose natural tumor potentialities are known. The question of the relation between artificially produced tumors and spontaneous neoplasms has not, in my opinion, as yet been determined.

DR. LEO LOEB (*Closing*): I had often thought that it would be desirable to test the effect of external factors in the production of cancer in making use of animals in which the hereditary tendency to a particular kind of cancer had previously been established. So far, I agree with Miss Slye. On the other hand, I do not agree with her view that external factors can only be active in individuals that have a high degree of hereditary tendency to cancer. On the contrary, I believe that if the intensity in the action of the external factors is regulated and the time during which it acts sufficiently prolonged cancer can be produced even in animals without hereditary predisposition or a relatively slight quality of it. The experiments made in animals in different countries, in which the percentage of positive results obtained is very high, and the experiences of man (roentgen ray workers), seem to me to be quite decisive in that respect. As I stated, a certain inverse ratio does probably exist between the amount of external or internal stimulation necessary and the amount of hereditary predisposition in cancer.

The Gall-Bladder*

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THE term "Gall-Bladder" when applied to roentgen diagnosis seems to be shrouded in mystery. So much so that it has been termed the romance of roentgenology. However, it is remarkable how today the roentgen diagnosis of a pathological gall-bladder is being so frequently substantiated at the operating table after the proper roentgen routine has been inaugurated.

Many articles have been written on the roentgen diagnosis of a pathological gall-bladder, but all of them advocating only partial methods until George in July, 1917, read a paper before the American Roentgen Ray Society on the roentgen findings of a pathological gall-bladder. No other substantial contribution was made to the literature until December, 1920, when Kirklin read a paper before this society substantiating George's findings. Both of the foregoing used every known roentgen method in arriving at their conclusions, including the use of the fluoroscope, an opaque meal and serial plates. In order to substantiate their findings I am contributing the results of my series of cases.

It seems that many men in reporting their findings report only on the basis of roentgenograms, and on the presence or absence of gall stone shadows. This is obviously in error, as the roentgen examination has not been concluded merely by taking plates or films. Gall stones have been classified into those containing calcium and those lacking this element. It is obvious that gall stones containing calcium can easily be shown, whereas if the stones are of the pure cholesterol type even the best plate made may not bring them out. Other evidence can well be considered at this point. Every patient submitted for gastro-intestinal examination is, or should be considered, a potential gall-bladder case. The patient must be properly prepared so as to eliminate, if possible, any shadow in the gall-bladder region due to gas or other intestinal contents. A series of double screen exposures are made of the right half of the abdomen changing the penetration of each one, so that the series will include, if possible, a set of films ranging from an under to an over penetration. Of course, if typical gall stone shadows appear then it is hardly necessary to do additional work.

Our routine, however, always includes the ingestion of an opaque meal and examining the patient under the fluoroscope for any further contributing evidence. The position of the stomach and duodenum is noted, special attention being paid to the mobility of the antrum and bulbous duodeni. Fixation of either one or the other, or both, with the stomach drawn to the right, with the bulbous duodeni under the right costal margin is at once highly suspicious of pericholecystic adhesions to the duodenum, provided both the stomach and duodenum are free from an organic defect. Care must be taken not to confuse the normal limited duodenal mobility of the hypersthenic type of patient, having a hypertonic stomach, with the pathological fixation due to pericholecystic adhesions.

Often, with or without fixation of the bulbous, the gall-bladder can be outlined by its pressure upon either the duodenum or stomach, producing an apparent defect. This can be readily differentiated from an organic lesion by the smoothness and concavity of the filling depression. Tender points are carefully noted so that they may be correlated to suspicious shadows on the roentgenograms. If possible, the patient is examined at twenty-four hours to determine whether or not the hepatic flexure is fixed in the gall-bladder area. This can also be done by the opaque enema, but care must be taken when this is done, that the findings of a high held hepatic flexure with a fully distended colon are not taken at face value. An increase of intracolonic pressure, due to the enema, plus the fixation of the colon by the mesentery is sufficient to hold the hepatic flexure up against the liver in many patients. Permitting the patient to evacuate, and re-examining the hepatic flexure, the release of the pressure upon evacuation would permit the flexure to drop down, if mobile. If pathologically fixed it will remain in its high held position under the costal arch.

By carefully noting the position and relation of the stomach and duodenum to the liver margin, also bearing in mind the tender points, one is now in a position to carefully consider the plates.

In our work, we have found one additional fluoroscopic sign that seems to be almost pathognomic of gall-bladder disease. This is a dilated duodenum with duodenal stasis, best viewed in the upright position. The barium shows this very clearly and easily. The entire

duodenum can usually be outlined from the pylorus to the duodenojejunal angulation, with frequently a constant churning or to and fro movement in the second and third segments, the barium often being forced back into the bulbous. Kirklin described this as lagging. It is equally as important a sign as duodenal fixation, if not more so, as it has been observed in a considerable number of gall-bladder cases in which the duodenum was freely mobile. Incidentally, the feeling of fullness which is one of the very common complaints of patients afflicted with diseased gall-bladders, seems to appear simultaneously with the presence of the barium in the duodenum. This observation has only been noted recently, and at a later date we hope to have sufficient statistics to demonstrate this beyond all doubt. It is true that duodenal dilatation and stasis may occur in other conditions such as ulcer, obstruction, pathological appendicitis, colitis, etc., but these can usually be ruled out quite easily.

As to the appearance of the gall-bladder on the serial plates, this does not conform with our usual conception as we see it on the operating table, as the appearance will depend upon the relation of the axis of the gall-bladder to the axis of the primary beams of x-ray projected on the plate. It may be pear shaped, round, ovoid, etc. It may lie anywhere between the diaphragm and the pelvis, over the spine, and to the right liver margin. We make no special attempt to look for stones, especially, as we have frequently missed stones found at operation, although having shown the gall-bladder outline on the plates. It is not necessary to show stones provided the gall-bladder itself can be seen. It is easier to demonstrate the pathological gall-bladder even with slight motion, due to breathing, than it is to demonstrate stones under the same conditions.

A satisfactory plate will show the liver outline, the kidney and the psoas magnus muscle. Any change in the gall-bladder, such as an increase in the density of the bile, the presence of stones, pericholecystic adhesions, thickening of the wall, etc., adds to the resistance of the gall-bladder to the x-ray so that it will cast a shadow denser than the normal. From our observations only pathological gall-bladders can be seen. I must qualify this, however, by noting that one case out of our series in which the gall-bladder outline was easily apparent was pro-

*—Read at Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

nounced normal by the pathologist. At operation it was soft, easily compressible, and without adhesions. It may be that the normal gall-bladder can be shown, but if so, it is in such an extremely small percentage of cases that for all practical purposes it can safely be considered that it will not record a shadow on the roentgenogram.

Caldwell in 1915 called special attention to the proper lighting for the observation of gall-bladder plates. I do not believe he emphasized it strongly enough. In my experience the solution of the light problem has been one of the big contributing factors in the recognition of the pathological gall-bladder upon the radiogram. Too frequently it is the experience of every roentgenologist that after he has spent five or ten minutes in accommodating his eyes to the light with which he is observing gall-bladder plates, that he is called upon to demonstrate to some one who has just entered the room, the presence of a gall-bladder shadow. This individual's eyes have not been accommodated, making it impossible or difficult to see properly, and as the result he feels that the roentgenologist is "seeing things." If it is insisted upon that every one accommodate his eyes for the examination of gall-bladder plates just the same as for fluoroscopy, it will be easy to convince those who doubt it that a pathological gall-bladder shadow can be detected with or without the presence of stones.

This report covers a series of about 550 gastro-intestinal cases seen during the year 1921 up to the present date, not including an absence of three months while on an investigating tour of Germany. Regardless of the clinical findings, each case was considered as a potential gall-bladder case, no case being considered completely examined without having taken multiple double screen exposures of the gall-bladder region.

Total number gastro-intestinal cases examined, 550. Total number cases with roentgen evidence of gall-bladder, 101. Total number of these cases operated on, 47. Total number operated on with confirmation of roentgen findings, 40. Total number operated on and not confirming roentgen findings, 7. Percentage of correct diagnosis of those cases operated upon, 85.

These figures, of course, speak for themselves, yet they must be analyzed. Out of 101 cases with demonstrable roentgen evidence of a pathological gall-bladder only 47 were operated upon, so that it has been impossible up to the present to determine the percentage of correct diagnosis on the basis of all of the gall-bladder cases demonstrated by roentgen methods. Further-

more, I have no statistics available of those patients in whom no roentgen evidence of a gall-bladder was found, and of those patients who were operated upon. It is an extremely difficult matter to follow up every case in a city like ours where the patients move from one institution to another. Many of the operative cases are treated mechanically, but will eventually come to operation. It might be a matter of years before all of them could be accounted for. I do not wish it understood that I feel that the clinical findings should be disregarded entirely in favor of the roentgen diagnosis. The two should be correlated, for I am sure that many gall-bladder cases exist which have not been demonstrated by the x-ray. However, the roentgen findings alone, of a diseased gall-bladder, are in many cases conclusive evidence.

An analysis of the failures includes one case with a soft, compressible gall-bladder, which was removed and pronounced negative by the pathologist; one case of a suspicious shadow the size of an orange, which proved to be a carcinoma; in two cases the gall-bladder was adherent to the head of the pancreas in such a manner as to cause the duodenum to take a very wide outward swing to the right and these cases were diagnosed as carcinoma of the head of the pancreas; two cases of soft, compressible, non-adherent gall-bladders were not removed by the surgeon; they were merely palpated and pronounced normal. I personally do not believe any surgeon can by inspection and palpation determine whether a gall-bladder is pathological or not. Nevertheless, we have included these among our misses.

One interesting case showing the presence of a large, single, calcified gall stone had to be differentiated from a renal calculus. Fortunately the stone was dense enough to cast a shadow on the fluoroscopic screen. By lateral rotation it was easy to demonstrate that the stone lay farther anterior than posterior, making it easy to rule out the possibility of a renal calculus.

The salient points in the roentgen interpretation of a pathological gall-bladder can be based upon the following factors.

1. The definite visualization of the gall-bladder upon the plate, either with or without stones.

2. Local tenderness under the fluoroscope corresponding to the area of the shadow seen upon the plate.

3. Immobility of the duodenum providing the patient is not of the hypersthenic physical type, where normally it is held almost immobile. Very obese individuals increase the difficulties of

satisfactory roentgenograms. The bulbous duodeni must be free from defect, although gall-bladder adhesions sometime cause an irregularity this is not the usual rule.

4. A high held immobile hepatic flexure lying in close relation to the liver margin.

5. The presence of a gall-bladder seat in the normal bulbous duodeni or in the antrum.

6. Duodenal stasis and dilatation.

CONCLUSIONS

1. The pathological gall-bladder can be demonstrated roentgenologically in at least 85 per cent of all pathological gall-bladders.

2. A careful routine examination of the gall-bladder should be made in every gastro-intestinal case, each patient being considered a potential pathological gall-bladder case.

3. A careful roentgen study of the gall-bladder should be made in addition to every clinical examination, utilizing every roentgen method available.

4. The normal gall-bladder is so difficult to demonstrate on a roentgenogram that it can safely be considered that the normal gall-bladder does not show.

5. The roentgen evidence alone, in a high percentage of cases, is satisfactory evidence of a diseased gall-bladder.

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The Cecocolic Sphincteric Tract*

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IN MAN the term "cecum" is applied to that part of the colon which lies proximal to the entrance of the ileum. Its average length in the adult, measured vertically, varies from two and one-half inches to three and one-quarter inches. The size of the cecum varies in different animals.

In the fish there is no large bowel. In the absence of a colon, there is, of course, no bacterial digestion, because a colon with the production of gas would upset the stability of the gill breathing forms.

In birds (Fig. 2) there is a chamber—the cecal colon—into which the ileum empties through the ileocecal sphincter. Communicating with this chamber by a single opening are two long sacculi, the ceca. The cecal colon communicates with a narrowed portion of the colon—the cecocolic sphincteric tract.

In the horse (Fig. 3) the cecum is a great culdesac, about four feet long, with a capacity of about seven to eight gallons. It is of conical shape. The body is attached dorsolaterally to the first part of the colon by the cecocolic fold. The ileum is inserted into the cecum on the mesial side. The cecocolic orifice is small in relation to the cecum and colon. It is a slit-like oval orifice and has a thick valv-

ular fold at its ventral margin and is encircled by a muscular ring, the sphincter colci. It is a regular sphincter, not a tract. At its origin the colon shows a constricted neck (two to three inches in diameter), the cecocolic tract, which gives way to a dilated part or sacculum, called the "vestibulum coli" (Schmaltz).

In man (Fig. 4) and the carnivora the cecum reaches only a moderate development. The human cecum approaches the herbivorous type more than the carnivorous.

There appears to be a relationship between the size of the cecum and the perfection attained by gastric digestion, suggesting that there is a reciprocal relationship in function between the stomach and the cecum. In some genera, Keith points out, the stomach, in other genera, the caput coli, is the main organ of digestion. The caput coli (true cecum) corresponds to the stomach functionally, embryologically and anatomically. According to Keith, it holds the same relationship to the large bowel as the stomach does to the small bowel. He also indicates that there is an anatomical and functional correlation between the cecal colon and the cardia of the stomach.

In ruminants the ceca are relatively small, while in all those animals whose gastric digestion is imperfect, like the horse, the cecum is very large.

In mammalian ceca, as exemplified

by the rat (Fig. 1), the cecum is, according to Keith, divided into three parts:

1. That portion which lies below or proximal to the ileocecal orifice, which is the true cecum or caput coli.
2. That portion of the cecum which lies above the ileocecal opening, which is the cecal colon.
3. The apical or appendicular portion of the cecum, which has a narrower lumen and thicker walls—the appendix.

The same three divisions exist in the human cecum, excepting that, whereas in the rat there is an additional sphincteric ring between the cecal colon and the cecum, which may be called the intercecal sphincter, in the human being this sphincter is represented by a vestigial strip of muscular fibers, the retinaculum (Fig. 4), which extends across the cecum, posterior to the lateral aspect of the gut and with which the two folds above and below the ileocecal opening merge. The cecal colon is considered to be that portion of the large intestine into which the ileum empties.

In birds, such as the ostrich, the cecal colon acts as a distributing chamber, the fluid part of the content being pressed through a sphinctered single opening in this atrium into the ceca (two long sacculi), while the solid portions pass into the colon through a relatively long, contracted area, the cecocolic sphincteric tract. The true

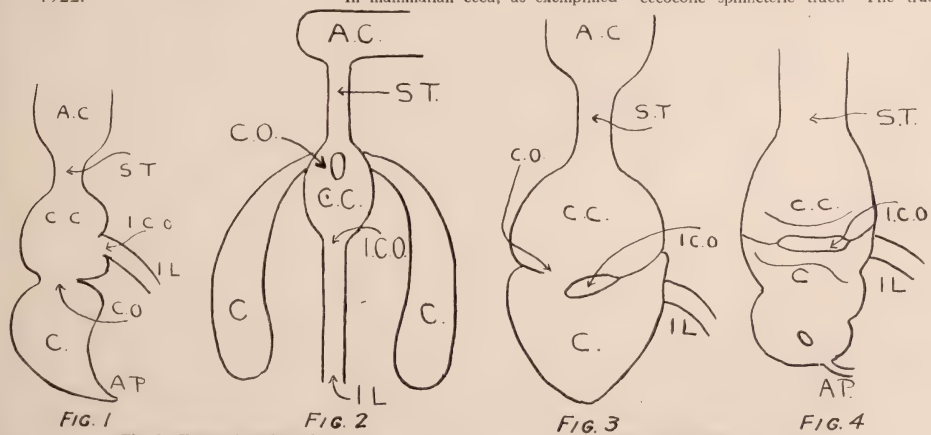


Fig. 1—Ileocecal region of rat.

Fig. 2—Ileocecal region of vegetable-feeding birds. In the grouse the ceca together are twice the length of the small bowel.

Fig. 3—Ileocecal region of horse.

Fig. 4—Ileocecal region of human. The upper and lower folds, which meet at the ileocecal opening, forming the retinacula, are indicated.

CC—cecal colon.

ST—sphincteric tract.

C—caecum.

IL—ileum.

CO—intercecal opening.

ICO—ileocecal opening.

AP—appendix.



Fig. 5—Proximal colon, hardened in situ (Quain's Anatomy). F—cecal colon, E—ileocecocolic orifice, C—cecum, D—orifice of appendix, A—Ileum, H—cecocolic sphincteric area.

cecum, therefore, is a chamber for prolonged digestion and absorption.

In the human being it is generally considered that the ascending colon begins just above the ileocecal orifice. A comparative anatomic study of the cecum would indicate that this is not a correct view, but that there exists above the cecal colon a sphincteric tract, which is imperfectly developed in human beings and functions in a greater or less degree, but is very well developed in air-breathing vertebrates, particularly those which live on a mixed or vegetable diet. Thus in the birds, the cecal colon is separated from the true ascending colon by a constricted area of narrow lumen (Fig. 2), well

supplied with circular, longitudinal and muscular fibers, which acts as a sphincter, controlling the emptying of the contents of the cecum into the ascending colon and hepatic flexure and preventing the flow in the reverse direction, which takes place under the normal antiperistaltic movements characteristic of this portion of the colon.

Not only in birds, but in the horse, this sphincteric tract is well marked. In the animals the location of this area varies, depending upon the size of the colon. If the cecal colon is a long one, the area is located near the hepatic flexure. If a short one, it is situated in the more proximal portion of the gut. According to Keith, even when the cecum is absent, as in about twenty-five genera of mammals, the commencement of the colon is separated by the ileocecal sphincter from the ileum, on the one hand, and by a more or less demarcated cecocolic sphincter from the remainder of the colon, on the other. Between these sphincters is the cecal colon. The cecum is really developed from this portion of the colon, as an outgrowth.

It is not so generally appreciated that the sphincteric area may sometimes be well developed in man, as a reversion to type or atavistic remains. The site of this tract can, however, nearly always be demonstrated by vestigial morphological or physiological markings. It therefore must be considered as a factor in the physiological study of the cecum and ascending colon and in the consideration of the pathological

conditions in this portion of the bowel. It opens in response to a chemical reflex from the cecum and appendix, just as the pylorus opens from a chemical sphincter from the duodenum, as will be discussed later.

The examination of the cadaver shows, in a proportion of cases, particularly when the intestines are hardened *in situ* (Fig. 5), between the gas-filled cecum and the true ascending colon an area, located from one and one-half to three inches above the ileocecal valve, which is firmly contracted and empty, in marked contrast to the gas-distended caput. This portion of the bowel appears to be in a state of tonic contraction.

In order to understand the regulating function of this cecocolic sphincteric area, it is necessary for us to consider the ileocecal sphincter.

According to Rutherford, the lower end of the ileum is controlled by a purely sphincter-like action of the circular intestinal muscle of the orifice. The musculature of the terminal part of the ileum extends for nearly four inches from the orifice.

The ileocecal outlet is controlled by strong, circular, muscular fibers, which, by their concentric contraction, keep the aperture closed till the condition of the contents, on one or the other side of the sphincter, initiates a reflex which relaxes the circular fibers, allowing the aperture to open and discharge more or less of the contents. This process may be assisted by the contraction of the longitudinal fibers.

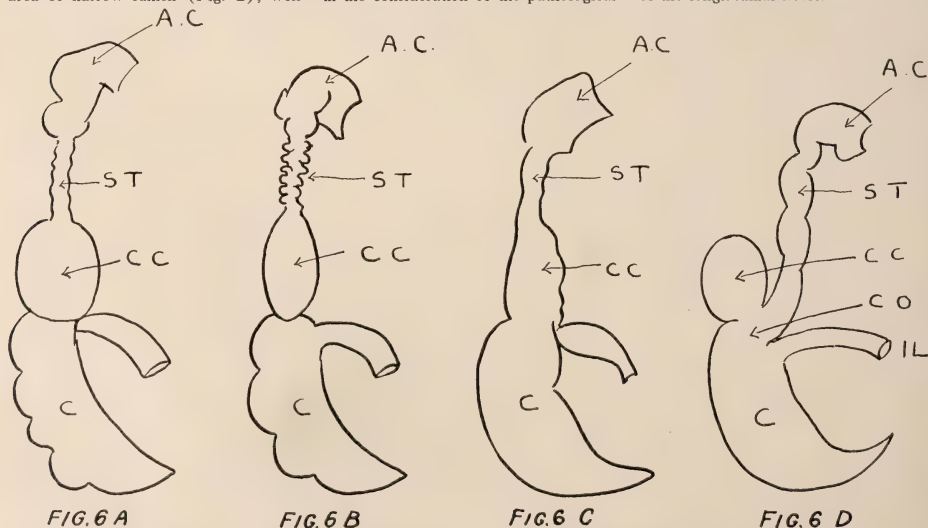


FIG. 6 A FIG. 6 B FIG. 6 C FIG. 6 D
Fig. 6—Illustrating four functional states of the ileocecal region of rats. In A and C the ileocecal sphincter is closed. In B and D it is open. In C and D it is open. Variations of the cecocolic sphincter are shown in A, B, C, D. (After Arthur Keith.)

Figure 5, taken from Quain's anatomy, shows the contracted commencing segment of the ascending colon in a specimen hardened *in situ*. The cecum, with its appendical opening, the cecal colon above the ileocecal orifice and the contracted portion above the cecal colon are shown in a specimen, intended to show the relations of the ileocecal orifice. The presence of this constricted area would explain the accumulation of gas in greater quantity than in the upper part of the ascending colon in a large percentage of persons. The entry of this gas into the ascending colon is impeded much in the same way as the sphincteric action of the terminal ileum prevents its egress into the ileum.

Through this sphincter, flatus and the semi-fluid contents of the ileum are discharged automatically, about a drachm at a time, at a rate depending on the degree of peristalsis. The semi-fluid contents thus discharged are churned about by a peculiar peristaltic activity into the cecum, so that the semi-fluid contents are inspissated and then pressed out of the pouches thus formed in the cecum, into the ascending colon through the sphincteric area, as pencil-like bodies which, being pressed together, form the characteristic lobulation observed in the feces.

The actual opening of the ileac valve seems to be the final part of a wave of peristalsis along the ileum. The peristalsis of the ileum ceases at the cecum. The cecal peristalsis is a movement peculiar to itself. The ascending colon peristalsis has its origin at the distal side of the cecocolic sphincteric tract.

The origin of the reflex controlling the sphincter at the ileocecal orifice and the cecal activity may be in a nerve center, located in the terminal ileum—the "pace maker" of Keith. The chemical stimulus from the mucous membrane of the cecum probably also plays a part in the regulation of the mechanism of the opening of the sphincter of the ileum and ejection of the contents of the ileum into the cecum.

In the cecocolic sphincteric tract there is the exhibition of a similar function, which serves the purpose of preventing the egress of the cecal contents into the ascending colon.

In the horse there is a mechanism by which the contents of the ileum may pass directly to the colon without entry into the cecum. This is true in most, if not all animals. The contents of the ileum pass into the cecal colon and not into the cecum. In the rodents and carnivora the content may pass some distance before antiperistalsis forces it back into the cecum. The cecal colon really acts as the antrum or distributing chamber. This anastaltic action in the

cecocolic sphincteric tract is myogenic in origin, and tends to repel the cecal contents from the ascending colon until cecal digestion and absorption is complete.

The contraction and relaxation of the cecocolic sphincteric area is probably also regulated by chemical changes similar to those which regulate the opening and closing of the pyloric sphincter and the opening and closing of the ileocecal sphincter.

Thus it is known that the reaction of the chyme in the terminal ileum is acid, while the contents of the cecum are alkaline. ⁽¹⁾ So, also, the reaction of the contents of the transverse colon differs from that of the contents of the cecum. The cecum is as sharply differentiated functionally from the ascending colon as the latter is from that portion of the transverse colon distal to the right one-third. ⁽²⁾

The control of the sphincters is through the sympathetic nervous system, and stimulation through the in-

ferior mesenteric plexus causes not only contraction of the various sphincters, but inhibition of peristalsis of the ileum and colon. The application of adrenalin produces the same inhibition here as in the stomach and pylorus.

Keith states that in the rat the action of the intercecal sphincter, which is undeveloped in man, and of the sphincter of the ileum are synchronized, when the latter is open, the intercecal sphincter is closed. (Fig. 6.)

A similar synchronism exists between the sphincter of the ileum and the cecocolic sphincteric tract. A disturbance between the synchronized action of these sphincters results in disturbed physiological action, which may be a factor in the production of organic disease.

FUNCTIONAL DISTURBANCES

Spasm: The spasm of this cecocolic sphincteric area of the colon may take place with a marked distention of the caput coli and the retention of cecal contents. What role the spastic con-



Figs. 7, 8 and 9—Radiographs illustrating the position of the cecocolic sphincteric area.

traction of this portion of the colon plays in the production of cecal stasis with its attending systemic symptoms and the consequent production of adhesions about the cecum and appendicular disease is not within the scope of this paper. It is an important factor in the production of these conditions. Roentgen studies would indicate that there is undoubtedly a reciprocal relationship and a reciprocal activity not only between the ileocecal and cecocolic sphincters, but also between these sphincters and the pyloric sphincter. Gastric hyperperistalsis and hypermotility are usually associated with peristaltic hyperactivity of the ileum and cecum. The sphincteric openings are concerned in this phenomenon.

It is conceivable that the entry of irritating content into the stomach with rapid pyloric evacuation and of rapid filling of the intestine, together with the quick arrival of this content at the ileocecal region and entry into the cecum might cause a spastic contraction of this cecocolic sphincter and lead to overdistension of the cecum. The sensation of pain would then appear as a result of this overdistension, for the pain sensation is due, not to contracture, but to increased tension on the bowel with muscular stretching. The overdistension would produce engorgement and on this fertile soil the bacteria would proceed with their roles in the production of appendicular and cecal inflammation. The cecocolic sphincteric area can be demonstrated in cases presenting the local symptoms of chronic appendiceal disease. The association of

gastric hyperperistalsis, hypermotility and intestinal hypermotility with colonic and appendiceal retention is well known. The hypermotility leads to haustral spasm with spastic constipation and cecal retention. Retention, in spite of hyperactivity, can only be explained on the basis of spasm of the cecocolic tract.

The roentgen examination of cases in which there has been a recurrence of symptoms, after the removal of the appendix, discloses in many cases the presence of a contracted portion of the colon, which corresponds to the site of the cecocolic sphincteric tract. We have demonstrated this on numerous occasions in the last three years.

Not only has this been demonstrated in our own cases, but it may be seen in the illustrations of others (See George & Leonard—"Pathological Gall-Bladder," Figures 252, 282, 287, 293, 331).

The roentgen examination has disclosed that this area is located at a distance of one and one-half to four inches from the entrance of the ileum into the cecum. Occasionally this contracted area has been noted more proximally to the hepatic flexure. Fluoroscopic palpation over this area elicits a sensitive pressure point. Manual pressure fails to obliterate this contraction. The area may be from one to two and one-half inches in length. It is frequently hidden in plate examinations by the haustra above and below it, but may usually be demonstrated in the

ventrodorsal examination or by the administration of a small contrast enema. The ordinary examination by enema does not as a rule disclose it because of the overdistension which such a procedure produces. The administration of antispasmodics will not always cause a disappearance of this contraction, even though there results relaxation in the haustral formations. The changes characteristic of the spastic or dyskinetic form of constipation may be associated with this spastic contraction of the cecocolic sphincteric area. It is necessary to differentiate spasm of this sphincteric area from a distortion in the colonic form, which results from the presence of adhesions and from benign stenosis, in this region.

ORGANIC DISEASE

It is pretty generally understood that areas of narrowing in the lumen of the gastro-intestinal tract are sites of predilection for organic disease. The portion of the colon corresponding to the site of the cecocolic sphincteric area appears to be a favorite site of ulceration, with fibrous stricture and pericolicitis and of tuberculous and malignant disease.

This portion of the colon is only second to the pelvic colon in the order of frequency of involvement by disease.

The symptom complex of cecal stasis may be extrinsic and congenital in origin, as when it is due to Jack-



Fig. 8.



Fig. 9.

son's membrane or to an abnormal attachment of the omentum to the front of the cecum and ascending colon, or intrinsic in origin when due to an inflammatory thickening and sclerosis of the cecocolic sphincteric area. Pericolicitis in this cecocolic region may result from a primary colitis or from a secondary infection due to cecal stasis, produced in both instances by extrinsic causes.

It would appear from the published records of malignant disease of the colon that carcinoma of the ascending colon is relatively rare, though the cecum is considered to be a very frequent site for malignancy.

Analysis of tumors of the colon, situated at a point distal to the ileocecal valve, which have been classed as cecal, will show when anatomical boundaries above described are recognized, that the majority of these tumors are really located in the sphincteric area.

The following factors must, according to Dr. P. D. Wilkie, be taken into consideration in the determination of the exact anatomical position of lesions which obstruct the lumen of the bowel in the region of the ascending colon: first, the variety of tumor, whether it is of the stenosing scirrhus type or of the fungoid, infiltrating type; second, the degree of obstruction produced by the lesion; third, the tendency of the disease to infiltrate and cause shrinkage of the wall of the gut; fourth, the competency or incompetency of the ileocecal valve. Thus a scirrhus carci-

noma may involve only a ring of the bowel wall, producing very marked stenosis of the lumen, but if associated with a competent ileocecal valve, there may result such a dilatation of the cecum and cecal colon as to displace the growth upward and make it appear as if the growth were located close to the hepatic flexure, when it really has its origin at a much lower point. If the growth be of the infiltrating type with but little obstruction of the lumen, the shrinkage of the caput coli may be such as to make it appear that the lesion is at the level of the ileocecal valve when it really has its origin at a higher point, in the cecocolic sphincteric area.

If there is an incompetency of the ileocecal valve, there will be no displacement of the tumor-bearing area even though the tumor is of the scirrhus type, but the terminal ileum will undergo marked distension. There is, therefore, both comparative anatomic, physiologic and pathologic evidence which would speak for the existence of the cecocolic tract in man.

SUMMARY

1. There is a proximal part of the colon in most herbivorous air-breathing vertebrates, which is normally in tonic contraction.
2. There is anatomic, physiologic and radiographic evidence pointing to the existence of a similar region in the human colon.
3. This cecocolic sphincteric portion of the colon exhibits an active repulsion

of the intestinal contents, until such time as cecal digestion and absorption are complete.

4. The contraction and relaxation of this portion of the bowel is undoubtedly regulated by chemical changes in a manner similar to the control of the pyloric opening and closing.

5. This sphincter may be thrown into spasm with the production of cecal distension and stasis and thus initiate inflammation.

6. The cause of the spastic condition is not always removed by appendectomy, for it may be demonstrated in cases in which there is a reappearance of symptoms after removal of the appendix.

7. The pathological lesions of the alimentary tract are more likely to occur at points at or just proximal to regions of anatomic or physiologic constriction or where there is a change in the nature of the lining epithelium as in the esophagus, the cardia and pylorus. The cecocolic sphincteric colon may be considered to be one of these areas.

FOOTNOTES

(1) The mucous membrane of the cecum is supposed to secrete a viscid alkaline fluid.

(2) There is both anatomic and radiographic evidence of the existence of a tract similar to the cecocolic tract in the right half of the transverse colon, a short distance from the hepatic flexure. This is the division point between the proximal and distal portions of the colon, the functions of which differ.



Roentgen Ray Anthropometry--(The Skull)

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PROGNATHISM

PRICHARD designated under the term of prognathism one of those three forms of heads in which the length or prominence of the jaws is a characteristic feature to be observed among inferior African and Australian savage peoples. Later Retzius used the word orthognath to signify a meaning opposite to prognathism. The profile of the face is virtually always oblique and the jaws protrude beyond the vertical line drawn from the glabella or nasion. Since all faces extend beyond this vertical plane orthognathism and opisthognathism are reduced to relative significance and mean, therefore, minor degrees of prognathism. According to Topinard, prognathism expresses the inclination of various lines made by certain facial planes with the horizontal.

Topinard early directed attention to a division of the study of prognathism from three viewpoints which he separately describes under the titles "prognathisme facial superieur," "prognathisme maxillaire superieur" and "prognathisme alveolo-sous-nasal." The method of determining the various degrees of prognathia for each of these types is that of the double square as elaborated by Topinard and Broca. The question of prognathism bears intimately on that of the facial angle as propounded by Camper; and there are two general methods for the estimation of this index. Using the nasion, the alveolar point, and the gnathion, lines are drawn to the basion and the two angles included between these three lines express one form of prognathic interpretation. The second general method consists in connecting the points mentioned with each other, and measuring the angular deviation from a horizontal plane. This latter method, it is thought, more truly expresses prognathia than the former. The topic will be more fully discussed in the next section of this thesis, where the general consideration of measurements is presented.

SECTION B—METRIC

CATALOGUE OF LANDMARKS

Before describing the methods for measuring as they obtain in this system of roentgen ray anthropometry, it is essential that certain established anthropologic landmarks be identified on the roentgenogram of the skull. The more usually used landmarks, as gathered from Topinard, Martin, Cunningham, Hrdlicka and modern texts on anatomy,

will first be presented and their definitions supplemented; and after these, certain new points of the endocranium that have never before been propounded, but that form useful adjuncts, will be described.

Alveolar Point—This is defined by Topinard as the most anterior point at the inferior extremity of the alveolar process of the upper jaw. Broca defined it as the lower extremity of the intermaxillary suture. Hrdlicka defines it as the lowest point of the upper alveolar arch between the median incisors. On the roentgenogram it is defined as the point included at the juncture of the alveolar process and the surface of the median incisors. At this junction the roentgenogram generally reveals a small notch which coincides quite accurately with the alveolar point as described by Hrdlicka.

Asterion—The point of meeting of the temporo-parietal, temporo-occipital and lambdoid sutures. It is seldom revealed on the roentgenogram and requires no consideration in connection with roentgen ray anthropometry.

Basion—The middle of the anterior margin of the foramen magnum. In median sagittal view of the skull, in the living, the basion is not roentgenographically revealed. In place of the basion the uppermost point of the silhouette of the ovoid external auditory meatus is used for purposes of roentgen ray anthropometry.

Bregma—The point of junction of the coronal and sagittal sutures. In the majority of roentgenograms this point is quickly recognized; in others it must be sought by extending the hair-line silhouette of the suture to the external table of the vault. In every case the exact location of the bregma can be visualized or judged.

Dacryon—The point of junction of the lachrymo-maxillary, fronto-maxillary and fronto-lachrymal sutures. It is of little significance to the roentgenologist.

Glabella—A point midway between the two supraorbital ridges. It is identified on the roentgenogram as that portion of the frontal sinuses that bulges most anteriorly above the silhouette of the orbital roof.

Gonion—Point of the angle formed by the ascending branch with the body of the lower jaw. On the roentgenogram the gonion on the right and left side is simultaneously revealed. When the exposure is made in the dextro-sinistral posture the left jaw, being nearest

the plate, casts a silhouette that may be identified on the roentgenogram as smaller than the right jaw, which is further removed from the plate; so that roentgenographically the gonion to be used for anthropometric measures is that revealed on the smallest lower jaw outline.

Gnathion—See Menton.

Inion—The most prominent point of the external occipital protuberance. Now of secondary importance, it may be absent in some cases, or may be present as a double point with a depression between.

Lambda—The meeting point of the sagittal and lambdoid sutures. Easily identified in most roentgenograms.

Maximum occipital point—The point on the squamous part of the occipital most distant from the glabella. It is identified on the roentgenogram with the centimeter scale, the zero end of which is applied to the glabella, and with this point as a pivot the scale is encircled over the occipital silhouette noting that point on the outer table farthest distant from the glabella. In the identification of the maximum occipital point, the maximum anteroposterior diameter of the skull is ascertained.

Menton—The lowest point in the middle of the bony chin. In median sagittal projection, the lower jaw casts a typical silhouette of the symphysis. This may be recognized on the roentgenogram as an elongated ellipse holding the inferior median incisors at its upper pole and the menton at its lower pole. The walls of the ellipse are plainly recognized as radiopaque boundaries including between them the spongy reticulum of the alveolar process. Roentgenographically the menton is the lowest point on the silhouette of the symphysis.

Nasion—The nasion is the median point of the nasofrontal suture. It is always to be identified on the roentgenogram where it reveals itself as a distinct notch between the nasal and frontal bones.

Obelion—The point on the sagittal suture on a line with the parietal foramina (when both foramina are absent the point may be estimated by comparing various skulls. In the roentgenogram the obelion is not revealed; nor does it have any roentgenographic significance in this study).

Ophryon—The central point of the smallest transverse diameter of the fore-

head measured from one temporal line to the other. (Obsolete.)

Opisthion—The middle of the posterior margin of the foramen magnum. This can not be visualized on the roentgenogram excepting in rare cases, and is, therefore, not used in this survey.

Pogonion—The most prominent point of the bony chin. Easily observed on the roentgenogram.

Pterion—The point of juncture of the sphenoparietal articulation.

Sub-nasal points—The lowest point, on each side, on the lower border of the nasal aperture. These points are lower than the top of the nasal spine; but in roentgen ray anthropometry it suffices to use the point on the nasal spine.

Stephanion—The point where the coronal suture crosses the temporal line. It is not visualized on the roentgenogram. It is obsolete.

Vertex—The summit of the cranial vault. Roentgenographically, it may be represented as the greatest diameter from the external auditory meatus to the vault.

In addition to these landmarks there is one used in cephalometry that may also be utilized in roentgen ray anthropometry. In the roentgenogram among the air cells of the mastoid will be observed an ovoid radiopacity representing the silhouette of the external auditory meatus. This oval is traced with a soft pencil. The uppermost point of the oval thus traced is especially marked and forms the basis for the measure of many diameters. It is cumbersome to refer to this newly submitted point by its full name, the uppermost point of the external meatus; so that this phrase may be arbitrarily condensed into the single word "akoustion." In this thesis akoustion will be used to mean the roentgen ray anthropometric landmark just described.

The supra-endoglabella is the point obtained as follows: When the maximum length of the skull is ascertained, which includes the distance between the glabella and the furthest occipital point, the endo-occipital point is established as that point inside the skull that corresponds to the furthest occipital point on the outside of the skull; and with the endo-occipital point as a pivot the rule is swung upward on the frontal bone until the maximum internal diameter is reached. This will be found generally at a point just above the frontal sinuses on the inside of the skull, which point is designated the supra-endoglabella.

The turcicon is the estimated central point of the sella turcica.

It seems undesirable to create additional terms for the already great anthropologic vocabulary, though there are certain undescribed points in the

cranium that permit of interesting roentgenological study. Reference is made to internal cranial landmarks. These will be designated by prefixing "endo-" before the particular landmark in question. The aim should be to reduce rather than to multiply craniometric measures and indices. Broca says, with aptitude, that given any two points on the cranium, these may be used for the determination of an arc or a chord the study of which offers a certain amount of interest; and so with angles and indices. The number of cephalometric landmarks is, therefore, indefinite. No landmark, however illy chosen, can be without some significance; but it remains that the best interest of anthropologic enquiry can be arrived at through the use of the fewest possible landmarks that afford the greatest amount of information. With this object in view, therefore, the roentgenologist will be interested in only the following roentgen ray anthropometric points:

Akoustion
Alveolar point
Bregma
Endo-bregma
Glabella

Supra-endoglabella
Lambda
Endo-lambda
Maximum occipital point
Menton
Nasion
Pogonion
Vertex
Endo-vertex
Turcicon

MEASURES

As in the landmarks, so are there in the measures of the skull endless possibilities for interesting observation. In Part IV of this monograph the Monaco Agreement and the Geneva Agreement are presented in full; but of the various measures of the skull and head presented in these two agreements, only these will be selected that are of roentgenologic interest.

It will be noted that no mention has been made of an anteroposterior exposure of the skull with the view of eliciting any of the lateral measures such as the maximum breadth or greatest transverse diameter. There are two reasons for this omission. In the first place with ordinary roentgenographic skill, it is a matter of extreme difficulty to secure plates that furnish sufficient detail for

NO. 2

ROENTGEN RAY ANTHROPOMETRY (Measures)

(Made according to prescribed Roentgen Ray Anthropometric Standard)

MEASURE					
1. Maximum length of skull. (glabella to occiput)					
2. Maximum internal length. (supra-endoglabella to endo-occiput)					
3. Akoustio-bregmatic height. (akoustion to bregma)					
4. Akoustio-endobregmatic height (akoustion to endobregma)					
5. Naso-menton diameter. (nasion to menton)					
6. Naso-alveolar diameter. (nasion to alveolar point)					
7. Facial depth.					
Identification number					
Name					
Age					
Sex					

Note: The values recorded are uncorrected for Roentgen-Ray divergence. To correct apply protractor reading of bob, which is _____.

A.—ROENTGEN CEPHALOMETRY

1. *Maximum length of the skull or greatest anteroposterior diameter.* This is the maximum glabella-occipital diameter of the vault. *Landmarks:* Anteriorly, the most prominent point of the glabella; posteriorly, the most prominent point on the occiput as shown by the maximum distance determinable by the centimeter rule.

A—ROENTGEN CEPHALOMETRY

1. *Maximum length of the skull or greatest anteroposterior diameter.* This is the maximum glabella-occipital diameter of the vault. *Landmarks:* Anteriorly, the most prominent point of the glabella; posteriorly, the most prominent point on the occiput as shown by the maximum distance determinable by the centimeter rule.

2. *Maximum internal length of the skull or greatest endoanterior-posterior diameter.* This is the maximum supra-endoglobella-endo-occipital diameter of the vault. *Landmarks:* Anteriorly, the supra-endoglobella; posteriorly, the internal cranial point immediately perpendicular to the corresponding most prominent point on the external occiput.

3. *The akoustic-bregmatic height.* This is the distance in centimeters and millimeters separating the akoustion and bregma. *Landmarks:* Inferiorly, the akoustion; superiorly, the bregma.

4. *The naso-akoustion diameter.* This is the length between the nasion and the akoustion. *Landmarks:* Anteriorly, the nasion or median point of the naso-front suture; posteriorly, the akoustion.

5. *The akoustio-alveolar diameter.* The strip between the akoustion and alveolar point. *Landmarks:* Anteriorly, the alveolar point; posteriorly, the akoustion.

6. *The nasomenton diameter.* The distance separating the nasion and menton. *Landmarks:* Above, the nasion; below, the menton.

7. *The naso-alveolar diameter.* The distance between the nasion and alveo-

lar point. *Landmarks:* Superiorly, the nasion; inferiorly, the alveolar point.

8. *Height of the symphysis of the lower jaw.* Landmarks: Superiorly, the highest point of the alveolar border; inferiorly, the menton.

B—CEPHALOMETRY

1. *Maximum length of the head or the maximum anteroposterior diameter* determined as on the skull. *Landmarks*: The perpendicular projection of the glabella onto the silhouette of the skin surface, and posteriorly, the perpendicular projection of the most prominent occipital point onto the skin.

2. *Height of the head. Landmarks:* Superiorly, the perpendicular projection of the vertex onto the skin; inferiorly, the akoustion.

In addition to these a useful measure in connection with the cranio-facial angle, as modified from that presented by Bean, consists in the following: The nasion and menton are connected by a straight line. The shortest distance between the akoustion and this line is measured and recorded as the *facial depth*. There are many other measures that can be taken and used to great advantage. It is only necessary to consider the ones enumerated, as these conform with great accuracy to similar measures conducted on the skull or in the living by the accepted formulae promulgated by contemporaneous anthropologic authorities. The measures above described will be referred to as the roentgen ray anthropometric standards. To systematize and to expedite the records, a chart for recording these various measures may be compiled. The one used in this study is shown in stencil No. 2. At the foot of this chart the notation occurs that the recorded measurements are uncorrected for roentgen ray divergence. Either at the conclusion, but better at the beginning of a series of measurements, the divergence protractor is applied to the roentgenogram and the bob reading immediately recorded on the sheet, and the coefficient used for correcting the distorted lengths to their true values.

CAPACITY OF THE SKULL

An estimate of cranial capacity corresponds closely to the volume of the brain. It is, therefore, of considerable importance though extremely difficult to arrive at. In the case of the dry skull a special technique must be followed according to the various methods which Hrdlicka divides into five groups. Though varying in the method of attack, these five groups represent various means for filling the skull with some substance, the volume of which is afterwards measured.

Methods for computing the cranial capacity have been submitted by Beddoe and Froriep. Froriep's method is

No. 3

ROENTGEN RAY ANTHROPOMETRY

(Indices)

INDEX					
1. Endocranial module; (sum of supra-endogliabella and 1/3 twice akoustio-endobregmatic diameters,	:	:	:	:	:
2. Facial angle; Included between naso-alveolar and akoustio-alveolar lines.	:	:	:	:	:
3. Sphenoidal angle; Included between naso-turcicon and turcico-akouston lines.	:	:	:	:	:
4. Height index; $\frac{\text{akoustio-bregmatic} \times 100}{\text{maximum length}}$:	:	:	:	:
5. Cranio-facial index; naso-menton plus facial depth x 100 Maximum length plus akoustio-bregmatic	:	:	:	:	:
6. Jaw-face index; naso-alveolar x 100 naso-menton diameter	:	:	:	:	:
Identification number	:	:	:	:	:
Name	:	:	:	:	:
Age	:	:	:	:	:
Sex	:	:	:	:	:

an advancement over that communicated by Beddoe and will, therefore, be discussed at this time. Friorie determines the relation that exists among the diameters of the three ellipses of the skull; that is, the horizontal, the vertical and the median sagittal. His studies show that by halving the value for each of the diameters of these ellipses and multiplying their combined products by $4/3$ of π ($4/3$ of 3.1416) a figure is arrived at which very closely approximates the measured capacity of the skull. In his study it was attempted to develop a system whereby the cranial capacity of the living head could be determined; so that for the basion-vertical height of the skull Friorie used instead the height between the vertex and the uppermost point of the external auditory meatus. Friorie arbitrarily assigned value for the thickness of the skull to be subtracted from the various lengths. The method of Friorie may be summarized as follows:

Let L—the length of the skull.

B—the maximum breadth of the skull.

H—the maximum height of the skull.

l—correction for length depending upon thickness.

b—correction for breadth.

h—correction for height.

The table of corrections is as follows:

		l	b	h
Sehr duennwandige ⁽¹⁾ Schadel	I.....	7	6	4
Duennwandige	II.....	9	7	5
Mittelstarke	III.....	12	8	5
Dickwandige	IV.....	15	10	7
Sehr dickwandige	V.....	18	12	8

From these measures and from this table, Friorie advanced the following formula:

$$\text{Capacity} = \frac{(L-l) (B-b) (H-h)}{2}$$

His monograph is accompanied by nearly 200 determinations in which the difference between the calculated and the determined capacity was shown in many instances to be slight, though it occasionally varied to the extent of 50 cubic centimeters and sometimes to over 100 cubic centimeters. It would seem that Friorie's method for estimating cranial capacity on the living is undoubtedly the best of any of the arithmetical methods advanced for this purpose. A weighty criticism that can be justly leveled against Friorie's method is the arbitrary manner in which corrections for the thickness of the skull are applied. To overcome this objection, an original method based on the measures derived from the roentgenogram will be advanced.

The ellipse may be recorded as obtained by a projection of the circle, and the ellipsoid by projection of the

sphere. Hence, the area of an ellipse whose axes are 2a and 2b is π ab, ($\pi = 3.1416$); and the volume of an ellipsoid whose axes are 2a, 2b and 2c is $4/3 \pi$ abc. Now, if the sagittal endocranial contour is traced it will be found to be very nearly elliptical; and the maximum internal anteroposterior diameter (endo-occiput to supra-endoglabella) approximately represents the major axis of this ellipse, or 2a. Similarly, the akoustio-endo-vertex height represents the axis of the coronal ellipse, or 2b. The axis of the breadth of the skull in many cases agrees closely in value to the axis for the height; so that for purposes of comparative study 2c may be considered as equivalent to 2b. From these considerations the formula for the volume of the endocranial ellipsoid becomes:

$$\frac{4}{3} \times 3.1416 \times a \times b \times b$$

or, simplifying—

$$\text{Volume} = \frac{a \times b^2}{2}$$

where

a—internal length, from supra-endoglabella to endo-occiput.

b—internal height, from akoustion to endo-vertex.

Since this method, the arithmetic of which is in every way similar to that used by Friorie, uses the internal measures of the skull, and thereby eliminates the arbitrary corrections for thickness, it should be expected and does give results that at least as nearly approximate the measured skull capacity as the corresponding values obtained by Friorie's formula.

Reichardt determined that the volume of the brain is about 10 per cent less than that of the skull capacity; so that 90 per cent of the calculated skull capacity may be used as the figure to represent the volume of the brain.

Since roentgen ray anthropometry aims for precision and simplicity, and further, because the endocranial form is not accurately ellipsoidal, these are excellent reasons for dismissing the calcu-

lation of cranial and encephalic capacity, and to use in their stead the so-called cranial module of Schmidt. Schmidt added the length, breadth and height of the skull and divided these by three, calling the figure thus obtained the cranial module. In a similar manner, the akoustio-endobregmatic height, doubled, and the maximum internal diameter of the skull, may be added and divided by three, giving a figure called the roentgenographic internal module of the cranium. Cranial capacity is calculated from the same figures that enter into the cranial module; so that the roentgenographic internal module forms a valuable index to cranial capacity in every way as useful as the calculated capacity. (For other discussions of formulae used in the estimation of cranial capacity see Topinard, Broca, Manouvrier, Beddoe, Lee and Duckworth.)

From a lateral view of the head alone it would seem conducive to error to obtain the cranial module by doubling the value for the height, on the basis that the breadth and height tend closely to approximate one another. That this error is not really an appreciable one can be demonstrated from the figures of Friorie, which figures are reproduced in the accompanying table. (See Table IV). In columns two, three and four of Friorie's table are given, respectively, the total length, breadth and height of the skulls. Friorie gives the dimensions in millimeters rather than in centimeters and fractions, which is the preferable custom. In column five, the cranial module calculated by the method of Schmidt and from the figures of Friorie is reproduced from Friorie's table; and in column six is given the cranial module calculated by taking one-third of the sum of the length and twice the height, again using Friorie's figures. It will be observed that the difference in the two methods in many instances amounts to a small fraction, so small as to be within reasonable experimental error.

ANGULAR MEASUREMENTS

From linear measurements one passes to measurement of angles. A considerable number of angles have been measured and described, but only those need be selected in which the value of the angle is significant in judging of the morphological conformation and comparative anatomical variation of the skull. The best known of these angles is the facial angle, useful as a means of illustrating the difference between the degrees of prognathia in different skulls, or better to study the evaluation of prognathism from fetal to adult life in a single individual with the view to establishing the apparent age of arrested development. As described by Camper,

TABLE IV (Continued).

Identification Number (Foriep)	1	2	3	4	5	6	7
	Length	Breadth	Height	Granal Module (Schmidt)	X-ray Module	Variation	
176	175	139	130	14.8	14.5	.3	
99	163	142	129	14.5	14.0	.5	
52	171	140	122	14.4	13.6	.6	
83	170	146	126	14.7	14.1	.6	
95	177	145	119	15.0	13.0	1.2	
92	175	141	122	14.6	14.0	.6	
133	175	149	127	15.0	14.3	.7	
195	180	141	125	14.9	14.3	.6	
28	176	144	122	14.7	14.0	.7	
177	179	145	125	14.5	14.5	.0	
167	169	155	135	14.7	14.6	.5	
186	175	145	121	14.7	13.9	.8	
35	174	144	125	14.6	14.1	.6	
137	167	146	120	14.7	14.1	.6	
106	168	145	127	14.7	14.1	.6	
211	182	138	131	15.0	14.8	.2	
42	172	142	128	14.7	14.7	.0	
11	181	145	133	15.3	14.9	.4	
40	174	141	121	14.5	13.9	.6	
173	169	138	127	14.4	14.1	.3	
138	176	142	127	14.6	14.3	.5	
194	171	138	134	14.7	14.6	.1	
202	166	138	132	14.9	14.4	.5	
210	177	143	127	14.9	14.7	.2	
43	177	147	128	15.1	14.4	.7	
120	167	137	129	15.1	14.6	.3	
225	165	150	127	14.7	14.0	.7	
179	173	140	131	14.8	14.5	.3	
84	170	145	130	14.8	14.3	.5	
159	170	138	130	14.9	14.9	.0	
68	174	151	125	15.0	14.1	.9	
135	179	142	133	15.1	14.6	.3	
103	167	146	126	14.6	14.0	.6	
163	179	139	131	14.8	14.5	.3	
92	172	138	130	14.5	14.6	.3	
101	177	145	132	15.0	14.5	.5	
89	162	147	120	14.8	13.9	.9	
33	164	149	125	14.6	14.8	.5	
113	168	141	128	14.6	14.8	.8	
141	202	128	132	15.4	15.6	.1	
22	173	147	127	14.9	14.2	.7	
162	179	139	131	15.0	14.7	.3	
128	179	149	133	15.4	14.8	.6	

TABLE IV.

EXPLANATION.—Columns 1, 2, 3 and 4 are copied from the table of Froepig. Column 5 is the cranial module determined from the figures taken from the table of Froepig by the method of Schmidt by adding the length of the endocranium and height and dividing by 3, the method of Schmidt by adding the length, breadth and height in millimeters. A usage that conforms more with the accuracy of the investigation is that of recording these values in centimeters and decimals; therefore, the cranial module of Schmidt as calculated from Froepig's figures is reported as a whole number and tenths. Column 6 is obtained by adding Froepig's value for the length and twice Froepig's value for the height, dividing by 3, and recording the result in decimals as it is not strictly a true expression of the cranial module. Column 7 is the cranial module of Schmidt by adding the length, breadth and height in millimeters and dividing by 3. The difference between the cranial module of Froepig and external diameter, whereas in roentgen ray anthropometry endocranial measures are used to determine the endocranial module. It will be noticed that the module of Schmidt and the x-ray module, as calculated from Froepig's figures and without applying any correction for the thickness of the part in either case, nevertheless agree with reasonably close approximation. It seems certain that were corrections applied for the thickness of the part and the module as calculated compared to the true x-ray endocranial module, the approximation of both values would be even closer than that already proved to exist.

1	2	3	4	5	6	7
Identification Number (Froepig)	Length	Breadth	Height	Granal Module (Schmidt)	X-ray Module	Variation
204	147	150	119	13.9	12.8	1.1
155	167	134	119	13.7	13.2	.5
110	160	135	119	13.6	13.3	.5
198	177	128	119	14.1	13.9	.3
203	162	140	127	14.3	13.9	.4
166	163	121	122	14.2	14.2	.0
224	169	142	116	14.2	13.4	.8
231	161	137	130	14.3	14.0	.3
59	172	137	125	14.3	14.1	.4
1	160	141	127	14.3	13.6	.5
130	165	139	124	14.3	13.6	.5
132	167	140	127	14.5	14.0	.4
230	168	139	126	14.4	14.0	.4
127	172	146	134	15.1	14.7	.4
9	163	136	125	14.1	13.8	.3
162	165	146	126	14.5	13.9	.6
37	180	136	120	14.6	14.0	.5
172	160	135	121	13.9	13.4	.5
58	178	140	129	14.9	14.5	.4
164	174	132	136	14.7	14.9	.2
76	171	135	132	14.6	14.5	.1
120	171	142	120	14.4	13.7	.7
60	172	137	131	14.7	14.5	.2

TABLE IV (Continued).

1	2	3	4	5	6	7
Identification Number (Protop)	Length	Breadth	Height	Cranial Width (Schmidt)	X-Ray Module	Variation
54	171	144	126	14.7	14.1	.6
55	172	145	127	14.8	14.2	.6
142	162	140	124	15.2	14.9	.3
143	163	141	125	15.3	15.0	.7
144	169	147	129	15.0	14.2	.8
32	167	147	129	14.8	14.7	.7
233	173	145	124	14.7	14.0	.7
168	180	144	126	15.0	14.4	.6
131	185	144	126	15.2	14.7	.5
6	175	145	127	15.1	14.6	.5
19	183	146	130	15.0	14.8	.2
218	176	144	127	15.0	14.2	.4
138	176	144	127	15.0	14.2	.7
220	176	140	129	14.6	14.5	.1
29	180	148	134	15.1	14.3	.8
123	187	143	133	15.4	15.1	.3
2	182	146	125	15.2	14.4	.6
66	187	142	135	15.4	14.6	.2
79	176	149	136	15.4	14.9	.5
109	183	149	136	15.3	14.8	.5
174	181	145	127	15.5	14.7	.8
172	181	145	127	15.4	14.7	.3
173	181	145	127	15.4	14.7	.3
209	180	146	133	15.4	14.9	.5
235	184	146	133	15.1	15.1	.5
23	172	147	129	14.9	14.3	.6
26	180	142	125	14.9	14.3	.6
171	172	142	125	15.4	15.3	.1
184	179	149	127	15.2	14.4	.8
192	172	149	127	15.4	15.1	.1
193	179	149	127	15.4	14.8	.6
183	179	149	127	15.4	14.8	.6
182	179	149	127	15.4	14.8	.6
27	177	146	133	15.2	14.2	.7
153	179	146	137	15.1	14.4	.7
13	173	147	132	14.9	14.2	.7
65	177	146	132	15.2	14.7	.5
212	176	144	136	15.2	14.7	.5
199	174	140	137	15.4	15.6	.2
104	176	146	129	15.0	14.4	.5
136	183	146	129	15.6	15.4	.2
130	178	146	129	15.0	14.2	.8
191	181	146	129	15.4	14.5	.3
80	181	150	127	15.1	14.5	.6
206	168	152	134	15.1	14.5	.6
197	186	154	134	15.1	14.6	.2
25	186	143	128	15.3	14.8	.5
136	184	143	137	15.2	15.3	.1
119	175	149	133	15.4	14.7	.5
207	182	138	141	15.4	15.5	.1

TABLE IV (Continued).

1	2	3	4	5	6	7
Identification Number (Protop)	Length	Breadth	Height	Cranial Module (Schmidt)	X-Ray Module	Variation
4	177	149	128	15.1	14.4	.7
213	185	139	142	15.5	15.6	.1
165	185	146	133	15.5	15.0	.6
95	180	141	127	15.2	14.7	.8
174	184	142	128	15.1	14.3	.6
199	186	146	133	15.3	14.6	.5
200	182	146	133	15.3	14.6	.5
182	182	146	132	15.4	15.5	.1
185	176	147	131	15.1	14.6	.4
59	180	146	136	15.5	15.1	.4
117	178	147	139	15.6	15.2	.3
131	176	146	136	15.5	15.6	.7
172	172	156	136	15.6	14.9	.7
31	175	145	133	15.5	14.7	.8
154	173	146	144	15.4	15.4	.0
130	171	148	139	15.3	15.3	.5
5	175	147	131	15.1	14.6	.3
214	174	143	139	15.2	15.1	.1
Von Mohl	177	146	140	15.4	14.2	.4
7	172	147	135	15.1	14.7	.6
219	180	151	135	15.3	15.0	.8
121	180	151	135	15.3	15.0	.8
218	185	148	135	15.7	15.2	.5
160	180	144	125	15.0	14.3	.7
224	180	144	127	15.0	14.5	.5
126	176	144	122	14.8	14.0	.8
144	176	146	132	14.9	14.5	.4
108	172	144	132	14.9	14.5	.4
3	181	146	127	15.1	15.5	.2
57	184	147	140	15.7	15.7	.2
196	184	147	137	15.1	15.3	.2
180	181	148	128	15.2	14.6	.6
130	185	143	139	15.6	15.4	.2
156	180	154	125	15.3	14.8	.1
94	186	145	131	15.4	14.9	.8
122	180	147	128	15.4	14.9	.1
178	178	152	128	15.1	14.5	.6
218	182	145	140	15.6	15.4	.2
102	180	156	135	15.7	15.0	.7
139	180	157	139	15.5	15.6	.1
48	183	137	133	15.5	15.6	.0
173	173	144	144	15.4	15.4	.0
96	180	145	131	15.7	15.1	.4
145	181	149	140	15.7	15.4	.3
175	189	146	132	15.6	15.1	.5
46	187	145	132	15.5	15.0	.5
24	177	156	129	15.4	14.5	.9
133	177	154	128	15.3	14.4	.3
229	177	156	136	15.6	15.0	.6

the facial angle is included between two lines, a facial line and a base line or horizontal. The facial line is tangential to the most prominent part of the frontal bone in the neighborhood of the glabella, passes downward and is tangential to the slight convexity forwards of the upper incisor teeth; the lack of definition of the latter lower point is due to the fact that the angle was described by Camper as determinable upon the head where clothed with the soft tissues as in life, just as conveniently as upon the macerated skull. The facial line in the head passes through the point of contact of the lips as seen in profile; this is best represented by the most anterior point on the surface of the upper incisor teeth, and this consideration has determined its selection in the skull.

The horizontal or base line adopted by Camper passed through the lower part of the nasal aperture downward along the line of the zygomatic arch,

and through the center of the external auditory meatus, and in the case of the measurement being made upon a head, the line approximately corresponds to that of the nostril as seen in profile. The two including lines are found to intersect in the neighborhood of the nasal spine and the angle thus formed was shown by Camper to vary from a comparatively small number of degrees in the skull of lowly mammals, ascending through the higher mammalia, and the apes, and thus gradually through the negro to the white human type, culminating in the idealized heads which Greek artists of antiquity gave to their masterpieces of sculpture (Duckworth). With the progress of anthropometry, and notably through the Frankfurt Congress, the definition for the facial angle gradually varied, being adopted in its final form at present according to the definition presented by Hrdlicka, the angle between the basion-

alveolar point and alveolar point and nasion lines.

For purposes of roentgen ray anthropometry the facial angle may be described as that included between two lines, the first drawn from the nasion to the alveolar point, and the second from the alveolar point to the akoustion. This very nearly corresponds with the definition given by Hrdlicka and affords comparable value that adds much to the study of the morphology of the skull.

SPHENOIDAL ANGLE

The sphenoidal angle was introduced by Virchow and studied by Welcker. In roentgen ray anthropometry it may be described as the angle included between two lines, the first drawn from the nasion to the turcicon (middle point of sella turcica), and the second from the turcicon to the akoustion. It presents an inverse evolution in man and in quadrumania, during growth. That is, in the sajou apes and in the orang the sphenoidal angle becomes more obtuse with advancing age; but in man, the reverse holds true, the sphenoidal angle becoming more acute as the individual passes from infancy to childhood, adolescence, and finally adult age. Obtuse sphenoidal angles in men point to platybasia and would indicate morphologically arrested basal skull development; and contrariwise, acute sphenoidal angles signify basal kyphosis indicative of exaggerated development.

OTHER ANGLES

Duckworth mentions other angular measurements that are made on the sectioned skull, and for which, therefore, the roentgenographic median sagittal projection of the cranium is admirably adopted. There are included the sphenomaxillary angle, sphenothmoidal angle and the foramino-basal angle. For a discussion of these various angular measurements, which will not be included here, reference may be had to Duckworth's "Morphology and Anthropology."

THICKNESS OF FLESH AND BONES

It may sometimes be of interest to study the relation that exists between the thickness of the cranial bones as sagittally projected and the immediately overlying fleshy structures for studying the thickness of the cranial vault, etc. The method described by Pacini is extremely useful. This method may be modified to include not only the inner table and the outer table of the vault, but also the skin. In substance, the method consists in drawing a base line that extends through the nasion, through the middle point of the sella turcica and the prolongation of the line joining these points through the occiput. The distance between the nasion and occipital point is halved. With this new point

TABLE IV (Continued).

1	2	3	4	5	6	7
Identification	Length	Breadth	Height	Oranial	X-Ray	Variation
Number	:	:	:	Module	Module	:
(Protop)	:	:	:	(Schmidt)	:	:
167	186	146	131	15.4	14.9	.5
97	175	150	129	15.1	14.4	.7
221	163	156	131	15.7	14.8	.9
178	169	150	134	15.8	15.2	.6
170	171	162	127	15.3	14.2	1.1
71	176	156	135	15.6	14.9	.7
34	185	152	133	15.7	15.0	.7
118	188	150	140	15.9	15.3	.6
114	179	148	137	15.5	15.1	.4
112	180	148	142	15.7	15.5	.2
227	184	148	132	15.5	14.9	.6
778	176	157	136	15.6	14.9	.7
90	186	151	126	15.4	14.6	.8
107	182	148	128	15.3	14.6	.7
74	178	147	136	15.4	15.0	.4
8	190	150	127	15.6	14.8	.8
53	173	147	129	15.0	14.4	.6
63	183	144	137	15.5	15.2	.3
81	173	153	130	15.2	14.4	.8
89	178	149	135	15.4	14.9	.5
50	191	154	126	15.7	14.8	.9
75	181	146	133	15.3	14.9	.4
85	174	149	134	15.2	14.7	.5
228	181	157	126	15.5	14.4	1.1
69	172	161	131	15.5	14.5	1.0
10	186	144	146	15.9	15.9	.0
87	180	153	135	15.6	15.0	.6
191	192	152	132	15.9	15.2	.7
56	176	153	137	15.5	15.0	.5
149	187	150	121	15.9	14.6	1.3
17	185	156	138	16.0	15.4	.6
41	178	153	133	15.5	14.8	.7
16	185	151	131	15.6	14.9	.7
140	184	154	129	15.6	14.7	.9
129	185	156	125	15.6	14.5	1.0
125	187	160	135	16.1	15.2	.9
18	189	155	141	16.2	15.7	.5
117	186	159	126	15.7	14.6	1.1
84	183	154	138	15.8	15.3	.5
72	188	153	139	16.0	15.5	.5
187	186	156	142	16.1	15.7	.4
222	180	154	133	15.6	14.9	.7
217	185	151	131	15.6	14.9	.7
82	184	155	127	15.5	14.6	.9
14	184	153	148	16.2	16.0	.2
193	181	155	132	15.6	14.8	.8
70	183	156	128	15.6	14.6	1.0
236	196	158	126	16.0	14.9	1.1
62	184	155	139	15.9	15.4	.5
	182	162	143	16.2	15.6	.6

as a center an arc is superscribed over the cranium. The radius of this arc as used by Pacini, is the distance between the central point of the base line described and the alveolar point. It is not necessary to inscribe a second arc. The one hundred and eighty degrees included in the semicircle are divided into ten sectors each eighteen degrees apart. On each of these sectors the thickness in millimeters of the skin is compared to the thickness in millimeters of the bone; and from these figures the relation that exists between bony and muscular structure can be measured and studied.

In general, the fleshy parts increase proportionally as the thickness of the vault increases; so that in the frontal region there is relatively thin flesh over a thin frontal cranium, and in the occipital region a thick flesh over a thicker occipital cranium. In some cases a reversed order may be observed, one in which there is a thick musculature over a thin frontal cranium, and a thin musculature over a thick occipital cranium. These cases seem to suggest anomalous development in which the bone grew independently of the muscular superstructure. In routine roentgen ray anthropometry so detailed a study as the measured relation that occurs between the muscle and the bone of the cranium need not be entered into. It is alone sufficient qualitatively to observe the general proportion that exists between these two structures and to note any deviation from the normal relation, considering as a normal relation thin vault and thin flesh, and thick vault with thick flesh.

SECTION C—INDICES

In the preceding sections an outline was submitted for studying craniologic description, to which was appended a list of measurements which prove useful in enabling comparisons to be made more exactly than by the method of inspection alone. It may be mentioned that certain writers in anthropology entirely disregard, or disregard to a large extent, the numerical craniometrical method. Sergi, of the Italian school, is foremost in the most recent move in this direction. The other extreme has been reached by such observers as Torok, Benedikt and others whose contributions to craniology are replete with vast numbers of detailed measurements. Measurements are of unquestionable utility and it is, therefore, incontrovertible that if they are made at all they should be derived by a method that insures accuracy and serves at the same time as a basis for adequate comparison.

Having obtained the numerical data the next natural step is a direct comparison of the corresponding figures re-

lating to different examples. Because of their usefulness and stability, anthropometric indices early gained great favor and importance and have also become greatly multiplied. The value of some, however, particularly that of the cephalic index, has been markedly overrated.

INDICES

The fundamental concept in the construction of an index is that the single numerical expression shall be so devised as to yield an "indication" of the proportion or relation obtaining between certain quantities, which in anthropometry have generally been limited in number to two. An index, therefore, expresses a percental relation of two measurements; and by custom it is habitual to use the smaller measurement as the dividend and the larger as the divisor, so that all anthropometric indices are less than one hundred.

The indices that it has been thought advisable to use in connection with this study may be enumerated as follows:

1. The height index, which compares the cranial height with the cranial length.

2. Craniofacial index, which is the relation obtained by comparing the dimensions of the head and face.

3. The jaw-face index, expressing the relation between the upper and the lower jaw.

HEIGHT INDEX

It was Retzius who first promulgated the cephalic index, the importance of which was exceptionally manifest from the beginning, but has subsequently been unduly overrated. The general form of the cranium, above all, depends upon the existing relation of its length and its breadth; and on these relations Retzius introduced the classification of dolichocephalic, or long headed races; and brachycephalic, or short headed races. An intermediate group was added by later writers and called mesocephalic (Broca). In working with the living head or skull the cephalic index is more readily and accurately ascertained than the height index; but in studying sagittal roentgenograms, the height index is easier to determine, and affords information as valuable as the cephalic index. In human crania, the height index varies quite directly with

the breadth index, so that where the skull is elongated (dolichocephalic), there is to be expected a small figure representing the height index. The height index is modified somewhat by age, by sex, and by race. In fetal stages the head tends to relatively greater height as compared to the length than occurs in adult stages. The female, usually relatively dolichocephalic, shows a correspondingly lower height index than the male. Inferior races that tend to dolichocephaly and sacrocephaly show also a low figure for the height index.

Mueller very carefully studied the profile curves of the skull of the newborn and their relationship to the birth canal and to the adult form of skull; and concluded from his studies that for each type of obstetrical presentation the head assumes a more or less permanent moulding with regard to its main diameters in a fashion to permit an inference as to the type of delivery from the general contour of the skull. The height-length index is determined from the following formula:

$$\text{Akoustio-bregmatic height} \times 100$$

Maximum length of skull CRANIO-FACIAL INDEX

From an anthropologic point of view, as well as in an anatomical sense, the skull is divided into two parts, the *cranium* and the *face*. Each of these regions has its special indications, while new characters again arise from their reciprocal relations. The cranium and the face are ontogenetically of different derivation. According to the vertebral theory the cranium is a modified vertebral vestige, as is also the facial framework; but the cranial modification has far exceeded the facial modification, so that while both are essentially of pristine vertebral origin, in their present form the face is more nearly vertebral than the cranium. An expression of the reciprocal relation that exists between cranial and facial development should, therefore, prove of valuable morphologic significance.

According to Bean the size of the face varies with age, sex, race and with inter-racial types; whereas the size of the head varies so little that it may be used to compare the size of the face,

TABLE IV (Continued).

1	2	3	4	5	6	7
Identification Number (Froriep)	Length	Breadth	Height	Cranial Module (Schmidt)	X-Ray Module	Variation
126	199	151	135	16.2	15.6	.6
86	195	161	133	16.3	15.4	.2
116	186	153	132	15.7	15.0	.7
12	190	174	126	16.3	14.7	1.6

obtaining in this way an index that provides at once the relative and absolute size of the face. The same author submits that the most complete cranio-facial relationship would be obtained by dividing the length plus the breadth, plus the depth of the face, by the length plus the breadth, plus the height of the head. Not all of these measures are usually secured, and Bean therefore utilizes two dimensions of the face and two dimensions of the head. He advances as the cranio-facial index the quotient of the chin to the nasion diameter plus the bizygomatic diameter of the face, divided by the glabella, to the maximum transverse diameter of the head. It represents the size of the face in terms of the head as one hundred. When the face is large the craniofacial index is large, and vice versa.

For roentgenographic purposes similar results may be obtained from the values of the height and depth of the face compared to the height and depth of the cranium. The roentgenographic craniofacial index may, therefore, be expressed by the following formula:

$$\text{Naso-menton diameter plus facial depth} \times 100$$

Maximum length of skull plus akoustio-bregmatic height
From roentgenographic studies the features of the growth of the face as represented by the craniofacial index is that in the girl the face is larger than in the boy at an early age; later the converse obtains, the face of the boy being relatively larger than that of the girl; and as adolescence is reached, the index again reverses assuming its pristine dif-

TABLE V		
Hypo-onto-morph	Meso-onto-morph	Hyper-onto-morph
Brachycephalic	Mesoccephalic	Dolichcephalic
Platyrrhine	Leptorrhine	Leptorrhine
Small stature	Medium stature	Tall stature
High umbilicus		Low umbilicus
Sound teeth	Sound teeth	Badly decayed teeth
Highly susceptible to diseases of the tissues derived from mesothelium (circulatory system)	Highly susceptible to same diseases as hypo-onto-morphs	Highly susceptible to diseases of the tissues derived from epithelium (central nervous system, alimentary canal)
Small face	Large face	Intermediate size face
Short legs	Long legs	Intermediate length legs
Short arms	Long arms	Intermediate length arms
Short, flat nose with depressed root and bridge, flaring nostrils that open forward	Large, straight nose with straight bridge depressed root, nostrils open downward and slightly forward	Long, narrow nose with high root, high bridge, nostrils open downward

ferentiation wherein the face of the girl is larger than that of the boy. According to Bean, and also as the result of roentgenographic survey among subjects showing endocrine deficiencies, the lowest facial indices are to be observed in those showing the highest height-length indices, and the highest craniofacial indices are found in those showing the lowest height-length proportions. Bean has divided subjects into three types which he calls, respectively, the

from the viewpoint of endocrine classification the hyperontomorph of Bean is distinctly an individual with a predominant thyroid syndrome.

JAW-FACE INDEX

The jaw-face index expresses the relation that exists between the face and jaw as measured by the nasomenton diameter and the upper jaw as measured by the nasolveolar diameter. Its formula is:

$$\text{Nasolveolar diameter} \times 100$$

Nasomenton diameter

The relations discussed are best recorded upon the form expressly provided for that end. One in keeping with the system used throughout for registering the findings is that shown as mimeographed form No. 3.

FOOTNOTE

(1)—(I, very thin; II, thin; III, medium; IV, thick; V, very thick.)



EDITORIAL

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The Role of the Radiologist

THERE is much discussion among the members of the medical profession as to the role of the radiologist. This unsettled state is a natural consequence of the newness of this specialty in medicine. The specialty has become so useful, however, that it may be helpful to discuss some of the fundamental problems which are involved in the relationship of the radiologist to those of his own specialty, to other members of the medical profession, and to the lay public. Without a proper conception of all these phases of his work, the radiologist is unable to function advantageously and he not only suffers, but his medical colleagues and his potential patients—the public—also suffer.

Radiology has a definite position in the practice of medicine which so far cannot be occupied by any other specialty. It enters every phase of the practice of medicine from the realm of fractures to that of neurology.

Although fractures were well diagnosed and well treated before the advent of the x-ray, it cannot be gainsaid that the use of the x-ray in diagnosis and treatment of fractures has promoted better diagnosis and better treatment. As one prominent surgeon recently jokingly remarked, "Before the x-ray came into medicine every fracture was perfectly reduced, but since then none of them are." The truth in this jest is that much more accurate information regarding fractures is now possible than before the x-ray was used. Not only does this information help in producing good alignment and good apposition, but it gives definite knowledge as to involvement of joint surfaces and in the differential diagnosis between a fracture and a sprain. Every surgeon of experience knows of fractures diagnosed as sprains before the advent of the x-ray, which today would be properly diagnosed by its use. A notable example of this value of the x-ray is in injuries to the carpal bones. In fact, a review of medical literature shows that fractures of the carpal scaphoid were infrequently recognized until about the year 1910.

Another field of diagnosis which has been greatly benefited by the use of the x-ray is that of gastro-enterology. The precise location of an ulcer of the stomach and accurate information as to size and character has made both the medical and surgical treatment of this condition more satis-

factory. In fact, it has helped the diagnostician to determine with greater certainty whether a given case should be treated medically or surgically. This accuracy of diagnosis has saved or prolonged the life of many patients by the early recognition of gastric cancer and the determination that it could be removed surgically. In this particular field one of our greatest surgeons has said that x-ray ranks second in importance in making a diagnosis of gastric lesions, the history being first and the other methods being of less value. This statement is made by a man who employs all methods of diagnosis, so that he cannot be accused of speaking with bias.

The specialist in urology has also been greatly assisted by the employment of the x-ray in diagnosis. The ability to definitely diagnose stone and to determine its location, as well as to give the exact size of the kidney and the kidney pelvis, has made diagnosis in urology one of the most accurate branches of medicine. Of course, this has been made possible by the use of the electrically lighted cystoscope in conjunction with the x-ray.

These are only a few concrete illustrations of the value of the x-ray in medicine. It would seem, then, that the x-ray has a three-fold value, namely, for positive evidence, for corroborative evidence, and for negative evidence. The concrete examples above illustrate the value of the x-ray in giving positive evidence. Many more could be cited in other branches of medicine. Many times, however, the diagnostician after carefully working over his patient, wishes corroborative evidence, so has the x-ray examination made to make "certainty doubly sure" in order that no doubt may exist in his mind that all the evidence possible has been obtained. In legal parlance, he does not want to pass a verdict until all the evidence has been presented.

The third value, that of the negative evidence, fits in closely with the routine employed by every diagnostician who makes his diagnosis "by exclusion" as so ably taught and exemplified by the late Sir William Osler. That method necessitates the ruling out of every possibility until only the one positive diagnosis remains. The x-ray aids materially in this process.

Every broadminded physician and every broadminded radiologist is compelled to admit that in a diagnostic way the x-ray is an aid, furnishing only a part of the evidence which is used in reaching the verdict medically called a diagnosis. In many instances the evidence furnished by the x-ray far outweighs that obtained by any other method and really contributes so much to the diagnosis that in one's enthusiasm one often thinks it is the diagnosis. In other cases its value is not so positive, but is none the less equally helpful.

It is well for the radiologist to be humble in his attitude toward the remainder of the medical profession, trying always to so equip himself with knowledge that his opinion and help will be sought on every occasion. This means that he must perfect himself in his knowledge of anatomy by study of the cadaver, that he must keep fresh his knowledge of pathology by constant attendance in the surgical operating rooms and the morgue, and that he must be willing to accept the truth regarding interpretations of his x-ray findings. The radiologist must be a teacher, not only in the classroom, but in his daily contact with his colleagues. This attitude on the part of the radiologist is necessary, because in the final analysis the radiologist is radiology, and on him must rest the responsibility of making the specialty what it is.

The field of radiology is so new that many things are yet to be done. Dr. Preston M. Hickey has recently called attention to the need of a uniform system of reports. This point is well taken, and the Journal of Radiology and the Radiological Society of North America could do no more important work than bring this about. It will take years of time to make such a plan universal, but it can be done. From now on the instructors in various medical colleges should follow a definite system of reports for radiographic examinations. In time this scheme, if followed, will give the outgoing medical graduates the proper view of systematic reports.

The development of the field of radiology depends upon the men engaged in it. This responsibility is a heavy one and only the strong man can stand up under it. The service which is demanded of the radiologist is peculiar in that it partakes of the purely laboratory phase of medicine and at the same time is clinical in its character. It really belongs to the clinical side of medicine, because it deals constantly with the actual patient rather than with some excretion or secretion removed from the patient. The work of the radiologist up to this point deals with the patient himself. On the other hand there is the service rendered to the referring physician. The role of consultant is the true position for the radiologist, and he must rise to that high plane if he expects to live his fullest. The radiologist should be guided by the same motto which has proven so valuable to the spirit of the Rotary Club:

"He Profits Most Who Serves Best."

This spirit has made the Rotary Club international in its scope. This spirit is peculiarly adapted to the field of the radiologist, and only by living it each day can he attain the highest pinnacle of this broad specialty. A clear conception of the sphere of the radiologist must be present in the mind of every man practicing this specialty. This unity of view and purpose, coupled with unity of action will result in the "greatest good to the greatest number."

The present day medical profession as a whole is passing through a fundamental change in its socio-economic relationship. As Dr. James A. Gardner says in the leading article of the Journal of the American Medical Association, August 12, 1922, page 515:

"The physician has always been too busy looking after the needs of his patients to give much time to his own interests."

It would seem that certain influences are causing the members of the medical profession to think more about the relationship of the profession to the outside world. Unless the whole body of medical men awakens to unified action, influences from without will do this thinking for them. Such organizations as the American Medical Association, the American College of Surgeons and the American College of Physicians are doing much to arouse their members to think about the broader relationship of the profession to the public. The underlying principles of the Radiological Society of North America are democratic and tend toward the same socio-economic attitude as the organizations just mentioned. The fact that the membership already exceeds that of any similar organization not only gives great opportunity for this kind of work, but thereby makes it mandatory upon the society to rise to its responsibility.

Brief reference to some of the work already started by the Radiological Society will give some idea of what can be accomplished. The founding of a research fund by the society deals with the very foundation of all progress. It will be recalled that the Lancet recently mentioned this phase of medicine and especially with reference to radiology, where it said in referring to the accomplishments of the British radiologists:

"We should lead in the subjects embraced under the general head of radiology. It is with pride we regard the great advances in physics which have had their origin in this country."

"The subject is in its infancy; the discoveries of the past may well be eclipsed by those of the future. Let us be prepared to do our share in these advances. *The only efficient way is by the organization and endowment of research.*"

The same sentiment can be embraced as a whole by the radiologists of North America.

Unified action of all agencies making up the radiological profession is also necessary if the most good is to be accomplished. With this in view the Radiological Society of North America followed the plan adopted by the radiologists of Great Britain and by the radiologists of Canada, in licensing technicians. The committee appointed to put this thought into action has completed the organization, and the process of issuing certificates to technicians passing a certain examination is already under way.

Abundant evidence that the public is awakening to thought of the medical profession is found in the lay press. Recent articles have appeared in the Atlantic Monthly, in the Century and in Hearst's International. The latter is written by Dr. Paul H. De Kruif and runs as a series following this first article entitled, "Doctors and Drug-Mongers." Mr. Norman Hapgood devotes his leading editorial to the article mentioned. This editorial is pregnant with thought. For example, Mr. Hapgood says:

"The series to which we publish this month the introduction, is of no use to those who wish the name of some pill, or some new medical nickname, by resort to which relief can be brought to heart-disease and hiccoughs, to erysipelas and earache, to corns and constipation. It is of no value to a fool. To those, however, who realize that the choice of a doctor is one of the most important of acts, and that medicine has exact technical basis, the series is indispensable."

The first article by Dr. DeKruif deals with the evils of a multiplicity of names for the same drug and also the schemes used in marketing these to both the medical profession and the public. The closing paragraph shows the thought which prompted the article:

"The medical profession is just now under fire from a pack of quacks and rogues. It knows that its use to the nation is great, and that the camorra of chiropractors, faith healers, and quickish rascals are parasites on our citizens. But its battle against cults and 'isms' and quackery could be waged more strongly were the profession to clear its own house."

When all this comment in the lay and medical press has been finished it is hoped the thoughts presented will result in action beneficial alike to the public and the profession. It should induce the profession to think more broadly and act with more unity than in the past. With this betterment of the medical profession the radiologist should keep well up in the procession of progress.

The Profession and the Public

THE relation of the medical profession to the public is extremely intimate, and this intimate relationship involves a correspondingly great responsibility.

When a man consults a physician he wishes, and has a right to expect, an honest opinion and sound advice. The doctor is supposed to know about disease; he is supposed to have made a study of its various forms and characteristics and of the means of combating it. If the opinion and advice received by the patient result in the cure of his ailment

or in improvement in his condition, the doctor will be respected and that respect will be reflected upon the entire profession; if the disease progresses in spite of the measures prescribed the doctor's ability will be questioned and other advice will be sought; and the quality of the advice sought is usually in proportion to the intelligence of the patient himself.

So, in studying the relations of the medical profession to the public, we must consider two things: the average ability of the profession and the average intelligence of the public.

The average ability of the profession depends, not only on the average quality of the instruction given in medical schools, but also on the average quality of the instruction given in the primary and secondary schools from which the medical schools draw their material.

During the past fifty years this country has grown at a tremendous rate, and this phenomenal development has kept flowing toward our shores a steady stream of more or less illiterate immigrants, each successive influx tending to keep down the educational average of our population. Our school system, still very imperfect, has been hard put in its attempt to keep grinding at least the rudiments of knowledge into this seething and more or less floating mass of immigrants.

One of the great defects in our common school system is its lack of uniformity in standards and curriculum, and in the average caliber of teachers. Until the status of the teacher is raised by adequate remuneration, by pride in his profession as the result of improved and uniform standards, and by the chance of advancement based on ability, we need not expect any great improvement in results. Better teaching, fewer fads, effort concentrated on fundamentals and in developing ability to think, would mean a tremendous saving of time and improvement in results.

The influence of the foregoing factors is still more apparent in the general intellectual average of the population. Recognition of and respect for, the medical profession depend very largely on the educational level of the people, and, therefore, improvement in general education must result not only in a higher average of professional ability on the one hand, but also in greater regard for the profession on the other.

The present curriculum of the medical schools of the country is overburdened with detail. More emphasis must be laid on the three great fundamental branches: anatomy, physiology and pathology, because, with a thorough knowledge of these branches, plus intensive cultivation of the powers of observation, analysis and logic, the solution of any medical problem becomes much less difficult and much more interesting.

The past ten years have witnessed a wave of overspecialization, so that the country is rapidly becoming flooded with specialists and near specialists. With the development of medical knowledge along the line of newly acquired scientific facts, one man cannot hope to keep up with the development in every field of his profession, but, before a physician can claim public consideration as a specialist, the public is justified in demanding reasonable proof of special training and experience.

No man can, in from six weeks to three months, acquire substantial mastery of any important field of medicine, and a specialist should be master of his particular field. Recognition of this fact is leading to more solid graduate instruction.

The multiplicity of state boards for medical licensure is another anachronism that should be done away with at the earliest possible moment. There should be one federal licensing board for the entire country with power to estab-

lish proper standards for the protection of the public. The idea of separate licensing boards for osteopaths, chiropractors, and so forth, is made possible by the ignorance of legislators and of the public of what constitutes proper standards in the treatment of disease. Human anatomy, physiology and pathology are the same no matter what ideas of treatment may be held by various sects. Osteopathy is an untested theory, whose proponents have thus far seemed unwilling to put it to a real scientific test. Christian "Science" is a state of mind which may be perfectly harmless in persons who are not suffering from organic disease, and may even be beneficial to certain types of nervous people, but which is nothing short of disastrous in the presence of organic disease. Chiropractice is, one might be tempted to say, the practice of chiro-mancy, a concoction of sanity and insanity, made up mostly of claims that will not bear unprejudiced investigation.

The development of medicine during the past fifty years has been phenomenal, due to the tremendous advances made in biology, chemistry and physics. The whole trend of modern medicine is toward the greater utilization of the so-called exact sciences in explaining phenomena observed in the living body. The physician of today must know a great deal more of those sciences in order to make intelligent use of them in studying disease and in devising means of counteracting it. However, there is a tendency on the part of many physicians to forget that science is but the means to an end and not the end itself, which is the alleviation of human suffering. The elaborate use of scientific methods of one sort or another must not be overdone. Many of them yield only relative or partial information, which may often be obtained by more simple means. As a result of this tendency the science of physical diagnosis is being neglected. This is particularly true among the younger members of the profession, who, instead of a careful examination of the chest, for instance, immediately decide that an x-ray plate will solve the whole problem. It is the path of least resistance, a path that leads to slipshod work and to the discredit of the profession.

From the point of view of the public, there is no doubt that medical treatment is becoming more and more a luxury. The growing affinity of medicine for science has tremendously increased the cost of treatment. The rich are in position to buy all the science they wish. The very poor, at least in the large cities, receive its benefits without charge. But to the millions in between, this mounting cost is becoming a serious problem. What with special laboratory examinations, hospitalization and the cost of nursing, the public is groaning under a steadily increasing burden. Solution has been attempted; such an attempt is the group system, but it is not proving a complete solution. Certainly there is a crying need for simplification of the procedures and of the medical art.

The general practitioner must remain the interpreter of modern scientific doctrine to the public who requires his services. He must make himself familiar with, and utilize in his treatment of patients, such newly acquired facts as have been demonstrated by research; or, if such new methods be too technical for him to utilize himself, he may seek the services of a qualified specialist. There is no reason why modern scientific medicine should be incompatible with a keen sense of sympathy and human understanding. The practitioner of today need not be less human than his namesake of fifty years ago. There is nothing that prevents him from being just as much a man and even better a practitioner, because present day medical training is infinitely superior. The result of such training, however, depends on the character and intelligence of the man himself. "Tel vaut l'homme telle vaut la chose."

A. U. DESJARDINS.

California Installation Requirements

THE Industrial Accident Commission of the State of California, in its proposed revised form of "Electrical Safety Orders" just issued, includes a section entitled "X-ray and High Frequency Apparatus."

For the benefit of subscribers residing in California especially, and for the information of all users of high potential apparatus of this nature, the section referred to is quoted in full:

X-RAY AND HIGH FREQUENCY APPARATUS

Order 284—Low-Voltage Circuits.

(a) Wiring. All of the conductors (except those which must necessarily be left exposed) shall be enclosed in metal conduit or metal wireways.

(b) Switch Required. A standard safety type switch shall be installed in the low-voltage circuit to each machine. Each switch shall be located within sight of the machine it controls.

(c) Protective Devices. At the location of the service switch or at the distribution center in each building in which x-ray or other high-frequency apparatus is operated, there shall be installed a standard device which will protect the wiring in the building from high-potential surges and induced currents. This protection may consist of one of the following devices connected between each wire and ground:

1. A mica condenser of not less than one-half microfarad capacity.
2. A resistance rod.
3. An incandescent lamp.
4. An aluminum lightning arrester. (On direct current systems only.)

Dangerous or troublesome currents may be induced in the light and power wiring of buildings in which x-ray or other high frequency apparatus is operated; and high-voltage or high-frequency currents may feed back from such apparatus into the light and power wiring in the building. It is, therefore, necessary, in order to prevent personal and fire hazard from such causes, to provide some device (such as those mentioned in Section c) of this order which will "drain off" from the light and power wiring such dangerous or troublesome currents. Since the ground connection on the secondary system (if it is grounded) may be at some distance from the high-frequency apparatus, each light and power wire entering the building must be connected to ground through a device which will "drain off" such dangerous or troublesome currents. These devices, in order to be effective, must be installed at, or near, the point of entrance of the service. They must be connected at all times or be so arranged that they will be automatically connected at all times when the circuit to the high-frequency apparatus is energized.

Due to the damage which might result to piping systems if the device used on direct-current systems offered comparatively low resistance to this current, it will be necessary on such systems to use a device (such as a mica condenser or aluminum lightning arrester) which offers high resistance to direct current, but low resistance to the high-frequency currents which it is intended to carry off.

Order 285—High-Voltage Circuits. (Within the machine case.)

(a) High-voltage parts enclosed in a wooden cabinet of an x-ray machine, shall be insulated sufficiently to prevent a discharge through the wall to the body of a person outside.

Order 286—High-Voltage Parts. (Attached to the outside of the case.)

(a) Barriers. Adequate mechanical barriers shall be provided to prevent the operator from approaching within dangerous distance of all high-voltage parts attached to the

case (such as spark gap, millimeter, and outgoing wiring). Parts not so protected shall be completely and adequately insulated. It is recommended that glass be used for the mechanical barriers, as it permits of examination during the operation of the machine.

(b) Operating Handles. All operating parts, such as spark gap handles and regulating handles, shall be made of suitable insulating material and shall be operative from the outside of the barriers.

Order 287—High-Voltage Wiring. (Outside of the machine case.)

(a) Strength of Overhead System. Overhead high-voltage wiring systems shall be so installed as to withstand a downward strain of fifty pounds.

(b) Height of Overhead System. No overhead high-voltage wires shall be placed at a distance less than eight feet from the floor of the room, and no terminals from cord reels, or other conductors, shall be permitted to hang lower than seven feet, six inches from the floor, except when actually connected and in use.

(c) Guarding High-Voltage Leads. The high-voltage leads on tilting tables and fluoroscopes shall be adequately insulated or so surrounded by barriers that contact with them is impossible. Tube terminals and high-voltage wires leading thereto shall be adequately insulated for a distance of twelve inches from the terminals. Shields for this purpose shall be designed to carry the high-voltage leads away from the patient in a direction at right angles to the long axis of the tube.

(d) Only One High-Voltage Device to Be Connected to Each Source. No arrangement will be permitted which will enable more than one piece of apparatus to be connected to the same high-voltage source at the same time.

Order 288—Grounding.

(a) All tube stands and fluoroscopes shall have their frames, operating handles, and all noncurrent-carrying metal parts grounded in conformity with the general grounding orders. For this purpose a flexible stranded cable is preferable to a solid wire which may break or become disconnected. Separate metallic tables shall not be grounded. Nonmetallic tables and chairs are recommended for all x-ray work, particularly in therapy.

Order 289—High Frequency Machines of the Quenched Gap Type.

(a) All low-frequency current-carrying parts shall be adequately insulated or protected mechanically so that they can not be touched during operation. This applies to all circuits except the high-frequency circuit proper, which delivers high-frequency current normally for therapeutic purposes.

Order 290—Transformers.

(a) Transformers which are a part of x-ray or other high-frequency apparatus, even though they contain oil, are to be considered and treated as a part of the device, and need not be installed as required for light or power transformers.

Order 291—Ventilation.

(a) Adequate ventilation shall be provided in x-ray rooms where anaesthetics are administered (owing to the danger of explosion).

A fire extinguisher of the carbon tetrachloride type should be provided in every x-ray room where a high-power transformer is used.

Southern Medical Association Meeting

THE sixteenth annual meeting of the Southern Medical Association will be held at Chattanooga, Tenn., November 13th to 16th, 1922.

The officers of the Section on Radiology are arranging an interesting program. Among other interesting features

will be a joint dinner to be held under the auspices of the Section on Surgery and the Section on Radiology, at which time Dr. George W. Crile of Cleveland, Ohio, and Dr. George W. Holmes of Boston, Mass., will discuss the treatment of hyperthyroidism from the surgical and radiological standpoints.

Visiting radiologists are assured a hearty welcome to all meetings of the Association, and, of course, all Southern radiologists are expected to attend.

THOMAS A. GROOVER.

Scientific Exhibit

THE Detroit Roentgen Ray and Radium Society will arrange a scientific exhibit for the annual meeting that will undoubtedly be the most interesting and comprehensive ever gotten together.

Dr. Preston M. Hickey of the University of Michigan will show a great deal of valuable and educational material.

Those members desiring to add to this important feature of the annual meeting should get in touch immediately with Dr. Rollin H. Stevens of Detroit, who is chairman of the committee and is personally directing the work.

By way of suggestion, this is one of the features of our meetings that has been too much neglected. It can be made well worth while. And under the supervision of the men named, it goes without question that the standard will be set where it should command the whole-hearted approval of every person in attendance.

Dr. Bloodgood's Series

THE interest already manifested in the series of articles upon diseases of the bone contributed by Dr. Joseph Colt Bloodgood of Johns Hopkins, and now running in the Journal, indicates the esteem and respect for Dr. Bloodgood which the profession generally holds, and the importance of the subject under discussion.

From every corner of the United States and Canada, and from men in all the specialties of medicine, come requests for copies. And with Dr. Bloodgood's attempt to contribute something on the subject every month so long as the material at his disposal lasts, it is entirely proper to surmise that the value of the series will become more and more apparent as time progresses. At the present time, Dr. Bloodgood has a fund of information founded on peculiarly signif-

cant cases which will without question make this series one of the most valuable and authentic contributions to medical literature.

It is to be hoped that the demands on Dr. Bloodgood's time in his teaching at Johns Hopkins will not prove so arduous that he will find it impossible to continue and complete this important work. It is an effort which lays a great debt on the medical profession, because no other person is quite so fortunately possessed of the data or the ability to do so arduous a task as is Dr. Bloodgood.

More About Technicians

THE response of the society membership in connection with the examination of technicians under the American Registry of Radiological Technicians, has been both inspiring and enlightening.

With about ninety-five per cent of the membership already heard from, only two or three conscientious objectors have been found. The balance, constituting as they do the big majority, not only express themselves unreservedly that this is a proper undertaking, but offer their services, time and money in any wise necessary to insure its success.

Many valuable suggestions have been offered. By way of explanation, it will take a little time to tabulate this wealth of data and get it into accessible and workable shape. Particularly is this true, when it is remembered that the organizational machinery for conducting these examinations involves an inordinate amount of detail which must be resolved into routine before the bureau can function as promptly and as efficiently as it is hoped to make it do.

The technicians themselves seem to be in hearty sympathy with the work undertaken. More than a hundred requests for applications have already been received and the applications mailed. So that it may be reasonably expected that in the not distant future a very substantial nucleus will have been created around which to build a highly effective and reputable organization.

With such a promising beginning, the conclusion seems absolutely sound that the Radiological Society of North America can accomplish much for the betterment of the science and the improvement of the standards of a very willing and loyal corps of assistants, by continuing this undertaking with fitting vision and forethought.



Commercial Exhibit, Annual Meeting

From the interest already manifested, it is safe to assume that the commercial exhibit at the annual meeting of the Radiological Society of North America, to be held in Detroit, December 4th to 8th inclusive, at Hotel Statler, will surpass anything of its kind in the history of the organization.

With all the available space sold and manufacturers and distributors of various appliances and apparatus clamoring that they be given room to show their wares, there is no question but that the capacity of the hotel will be taxed to the limit.

In this connection, it is probably only fair to say that the attendance bids fair to outnumber anything previously

of record in the science of radiology. A very comprehensive and instructive scientific program is being arranged, a scientific exhibit to which there has been nothing comparable in the history of the Radiological Society is assured, reduced railroad rates under the identification certificate plan will be in effect, and with the wide recognition that is being accorded radiant energy in its various forms both as a diagnostic aid and therapeutic agent, the meeting is sure to bring together an unusual number of men from all parts of the United States and Canada who are seriously interested in science.

The effort of the exhibitors will be to make their exhibits both interesting and educational. Each exhibit will be in the hands of competent men from whom information can be obtained without any embarrassment.

Exhibitors

Space No. 1—Patterson Screen Co., Towanda, Penn.

Space Nos. 2 and 3—Standard X-ray Co., 1932 N. Burling St., Chicago, Ill.

Space No. 4—Jno. V. Doehren Co., 208 N. Wabash Ave., Chicago, Ill.

Space No. 5—Radium Chemical Co., Marshall Field Annex, Chicago, Ill.

The Radium Chemical Company of Pittsburgh will have on exhibit the latest apparatus used in connection with radium work, and will demonstrate several new methods for handling radium. The present tendency is toward simplicity, and with that end in view, new instruments have been designed to simplify the handling and application of radium.

Following out the custom of having a radium conference in Pittsburgh either before or after all national meetings, we desire to announce that for this meeting the conference will be held from December 11th to 15th, and all members of the Radiological Society are cordially invited to be present.

Space Nos. 6 and 7—James Picker, Inc., 497 Lexington Ave., New York City, N. Y.

Space No. 8—Sagamore Chemical Co., Inc., 213-15 Water St., New York, N. Y.

Space Nos. 9, 10 and 11—Engeln Electric Co., 4601-11 Euclid Ave., Cleveland, Ohio.

Space Nos. 12 and 13—Victor X-ray Corp., 236 S. Robey St., Chicago, Ill.

Chief among the apparatus which will be on display will be the new Victor Stabilized Mobile X-ray Unit, a recent Victor achievement, which is radically different from any type of x-ray apparatus heretofore offered to the profession. The three most outstanding features of this new unit are the Stabilizer, Auto-Transformer Control and Circuit Breaker. The merits of the Stabilizer are already apparent to the majority of x-ray users throughout the country. Not only does this device eliminate the disadvantages due to line fluctuations, but it furthermore means a considerable saving in tube and film costs, not to mention the freedom from worry, and the certainty of results which will accrue to the user. The Auto Transformer control furnished with this new unit provides for twenty-six separate control steps, thus giving to the user a refinement of control that is truly ideal. The Circuit Breaker provided with this unit means not only pro-

tection to the tube, but also protection to the operator and patient.

Another Victor development which will be on exhibit is an improved type of stereoscope. This new outfit is the result of considerable experimental work by Victor engineers and combines features which make for a stereoscope of the utmost economy, simplicity of operation, beauty of design, and above all, even diffusion of light over the radiographs to be viewed, resulting naturally in more certainty in diagnosis.

The Victor line of Quartz Lamp Equipment will also be on display at the meeting. Both the Water Cooled and Air Cooled Lamps will undoubtedly attract the usual close attention on the part of the medical profession, but in addition there will be on display the new mobile hospital unit, which is designed so as to be conveniently wheeled from room to room.

Those in attendance at the meeting will also wish to carefully inspect the latest type of Victor High Frequency apparatus, a machine of portable construction delivering sufficient current for the treatment of any condition indicating the use of high frequency currents.

Space No. 14—Buck X-graph Co., 6629 Olive St., Rd., St. Louis, Mo.

This exhibit will consist of a display of X-Ograph Dental Film Packets, X-Ograph Developing and Fixing Chemicals, the X-Ograph Contact Cassette, and X-Ograph Universal Dental Film Mounts, including a dental film mount filing device and film viewer, incorporating a decided departure from the old method of mounting and viewing dental radiographs.

Space No. 15—U. S. Radium Corp., 58 Pine St., New York City, N. Y.

Space Nos. 16 and 17—Liebel Flarsheim Co., 410-16 Home St., Cincinnati, Ohio.

Space No. 18—Sweetbriar Laboratories, Inc., 1220-28 Hodgkiss St., N. S., Pittsburgh, Penn.

This exhibit promises something of unusual interest in the way of work done with the new Sweetbriar screens.

Space Nos. 19 and 20—Waite & Bartlett Mfg. Co., 53 Jackson Ave. Long Island City, N. Y.

OH. IMMERSED UNIT—This comes in a tank $2\frac{1}{2}$ inches long, 12 inches wide, 13 inches high. Mounted in the tank is the high tension transformer and a separate filament current transformer. Above this is placed the lead glass shield and 30 milliamperere radiator tube. The unit is ship-

ped having the oil in a separate container. The tube goes in the regular crate. The tube holder, however, is arranged so that it is a very simple matter to put the tube in the lead glass shield and mount it in the tube holder, which is permanently attached to the under part of the cover.

There can be an opening in the top of the box for the x-rays to come through, or it can be placed on the side. It can also be arranged so as to take the same shutter that is used with our fluoroscope.

This unit can be mounted on a carriage under a fluoroscopic table, or it can be mounted between two uprights having a counter-balance adjustable for height.

NEW MODEL RADIOGRAPHIC AND FLUOROSCOPIC TRANSFORMER WITH OIL IMMERSED AUTOMATIC THROW HIGH TENSION SWITCH—This transformer is in a tank 16 inches long, 12 inches wide, 14 inches high. In this tank is mounted a high tension transformer, filament current transformer and double throw automatic high tension switch. There is a double set of high tension terminals coming out of the top. When this is connected with the control cabinet or control panel, the high tension switch is automatically thrown one way or the other, according to whichever foot switch the operator steps on. This does away with having to stop to turn the high tension switch or to even give it any thought. A still greater advantage is that it does away with the oxidation which takes place in the filament circuit of the ordinary exposed high tension switch, causing trouble.

NEW MODEL CONTROL CABINET FOR THIRTY MILLIAMPERE TRANSFORMER—The same equipment, instead of being in cabinet form, the cabinet mounted on a slate base so that it can be readily placed against the wall.

This control cabinet can be used either with the fluoroscopic transformer or with the oil immersed unit. The switch-board or cabinet, contains the following:

Coolidge meter, voltmeter and milliammeter.

Auto-transformer adjustable in two-volt steps.

Adjustable overload circuit breaker with double silver contacts opening both sides of the line.

Automatic current regulator which will keep the milliamperes constant at five or thirty. This is controlled by means of a two-way switch which is marked "Fluoroscopic and X-ray."

Two connections for floor switches to be used either singly or in combination with the fluoroscopic transformer, having an automatic high tension oil switch.

A plug connection for floor foot switch. This is arranged so that it is impossible to use 30 milliamperes except when the switch is on the side which enables you to use the foot switch. In other words, you cannot possibly turn on 30 milliamperes with the ordinary foot switch.

There is another outlet which can be connected with a red light overhead so that when the foot switch is used the red light automatically goes out.

NEW MODEL G-U MASSACHUSETTS FLUOROSCOPIC AND BUCKY DIAPHRAGM TABLE—This consists of a table having the Bucky Diaphragm permanently attached to it and movable. At one end underneath is placed an oil immersed fluoroscopic unit which is adjustable six inches each way. Attached to the base of the Bucky is an upright which supports the oil immersed unit, arranged so that the rays come out of the bottom of the tank. This is accurately centered over the center of the Bucky so that after the operator has made a fluoroscopic examination, he can, without moving the patient, simply push the Bucky down to the other end of the table under the patient; the Bucky having been previously loaded with the film. The control board can be mounted at one end of the table if desired, so as to eliminate all wiring possible.

NEW AND ORIGINAL MODEL STEREOSCOPE—This is mounted on a counterbalanced stand so that the operator can sit down in a comfortable chair in front of it and make his examination without any discomfort.

The illuminating boxes are novel in construction, the curtains being placed inside of them but being adjustable from the outside. This enables the placing of a cross-bar so that the films can be readily held in position without any difficulty.

This apparatus stereoscopes very much easier than the ordinary type owing to the fact that the operator looks directly at one plate with one eye; while the other eye looks at the mirrored surface. It is hard to believe what a very great difference in clearness this arrangement results in.

UNITED STATES ARMY MOBILE UNIT—This is the model such as was made up for the U. S. Army in conjunction with the late Professor John S. Shearer of Cornell University, and represents the result of his experience in France. It has been designed with a view to economy of space without losing the advantages of universal adjustments.

This is in a cabinet 20 inches wide, 24 inches deep, 36 inches high. There is a 35 foot service reel permanently attached in the cabinet to be connected with the electric light service. There is space so that a rotary converter can be used to operate up to ten milliamperes, and mounted in this unit. The sides are all removable, so that every part is accessible.

This is a unit which every hospital should have. It will do all kinds of radiographic and fluoroscopic work. It is, of course, not suited for therapy or for instantaneous work; but it will answer the requirements of any small hospital.

LATEST IMPROVEMENT ON 10 K. W. INTERRUPTERLESS MACHINE FOR ALTERNATING CURRENT—This 10 K. W. Interrupterless Machine has been improved in the following ways:

All makes of alternating current interrupterless machines have polarity indicators; so that when the apparatus is put into operation the operator is supposed to look at the polarity indicator and then turn the pole changer switch one way or the other. If, however, he fails to do this and closes the operating switch, the polarity may be wrong and the possibilities of puncturing a tube are very great.

With this new arrangement, this is all absolutely avoided. It is simply impossible to turn on any high tension unless the polarity is correct. When the machine is started up there is a red light. If this lamp lights up the polarity is wrong. If, however, the operator neglects to pay any attention to it and goes ahead and closes the operating switch, nothing will happen, he simply cannot get any high tension. He will then, of course, look to see what is the matter and notice the red light, which means that the pole changer should be turned in the opposite direction. This device is exceedingly simple and there is nothing whatever to get out of order.

This unit also carries an auxiliary contact. This is for use in making automatic stereoscopic exposures in combination with the new electric-trip stereoscopic tubestand and electric-trip vertical plate changer. In order to do stereoscopic work with the new equipment, it is simply necessary to load the plate changer, place the patient in position, and have the tube in position for the first exposure. The operator then simply closes the operating switch. This will make the first exposure, and the instant it is over the tube will shift and the plate changer will revolve. During this period the time switch will reset itself; and the instant the second plate comes into position the second exposure will be made and cut off.

Space No. 21—French Screen Co., 406 McKerchey Bldg., Detroit, Mich.

Space Nos. 22, 23 and 24—Kelley-Koett Mfg. Co., Inc., Covington, Ky.

Space Nos. 25 and 26—Radium Co. of Colo., Radium Bldg., Denver, Colo.

The Radium Company of Colorado will exhibit a complete line of radium applicators and accessories. In addition to the usual instruments which have been regularly furnished with radium, the equipment shown will include numerous accessories of new designs.

The gold needle with platinum-iridium tip has been discontinued and needles of platinum-iridium or non-corrosive steel, are recommended. Possibly the most interesting development in needle design will be the new short length non-corrosive steel needles containing five milligrams each. These needle applicators, which are exactly one-half the length of the ten milligram needles and identical in external diameter, will be shown with accessories to facilitate application. The advantage in using the short needles of this design in conjunction with the standard long ten milligram needles will be demonstrated, with reference to the adaptability of standard screens.

A slender needle designed to contain three or five milligrams of radium element will also be included. Platinum-iridium needles of sufficient wall thickness to absorb all Beta radiation will illustrate the prevailing tendency in French design of such radium applicators. Brass capsule screens to contain needles have recently been added to the equipment not shown in the company's catalog.

Among new accessories for needles is a new type of needle introducer which has practically eliminated every difficulty in threading. The instrument is designed for imbedding non-corrosive steel needles. It will be shown in six, eight, ten and twelve inch lengths.

Another needle accessory is the flexible needle-holder, designed for use in conjunction with some standard form of operating cystoscope. This special needle introducer is supplied to meet a demand for a simple attachment for any standard instrument to avoid the necessity of duplicating the expensive lens system and other parts of the entire cystoscope. As an operating cystoscope is invariably found in the urologist's armamentarium, the new accessory will probably meet with general approval.

The result of considerable study and co-ordination of ideas obtained from numerous radium therapists will be seen in a new form of oesophageal applicator. The chief advantage claimed is the simplicity of design. The instrument will be shown in various sizes to contain either glass radium-containing tubes or metal needles.

A new form of metal lined carrying case for radium needles will be shown. This case has been designed to accommodate the wires attached to needles, thereby providing a satisfactory container to hold the needles when ready for application. The number of needle compartments is made to meet individual requirements.

Metal-covered plaques in the design of which a marked departure from existing practice has been made, will be shown with records to illustrate the advantage of the new instrument over the older form of composition-covered plaques. The radium in the new flat applicator is distributed directly beneath a very thin layer of Monel metal, which permits the passage of approximately three times as much Beta radiation as escaped through the much thicker layer of composition. These plaques are shipped in new lead-lined carrying cases which will also be included in the equipment shown at the Radium Company of Colorado booths.

Adaptable applicators have been designed to facilitate the application of glass tubes or metal needles in the treatment of skin conditions. Several types of these instruments will be shown, including applicators to hold two glass tubes in separate compartments, and instruments to contain five or more needles. In each instrument the primary applicator is held in position beneath a very thin layer of non-corrosive steel.

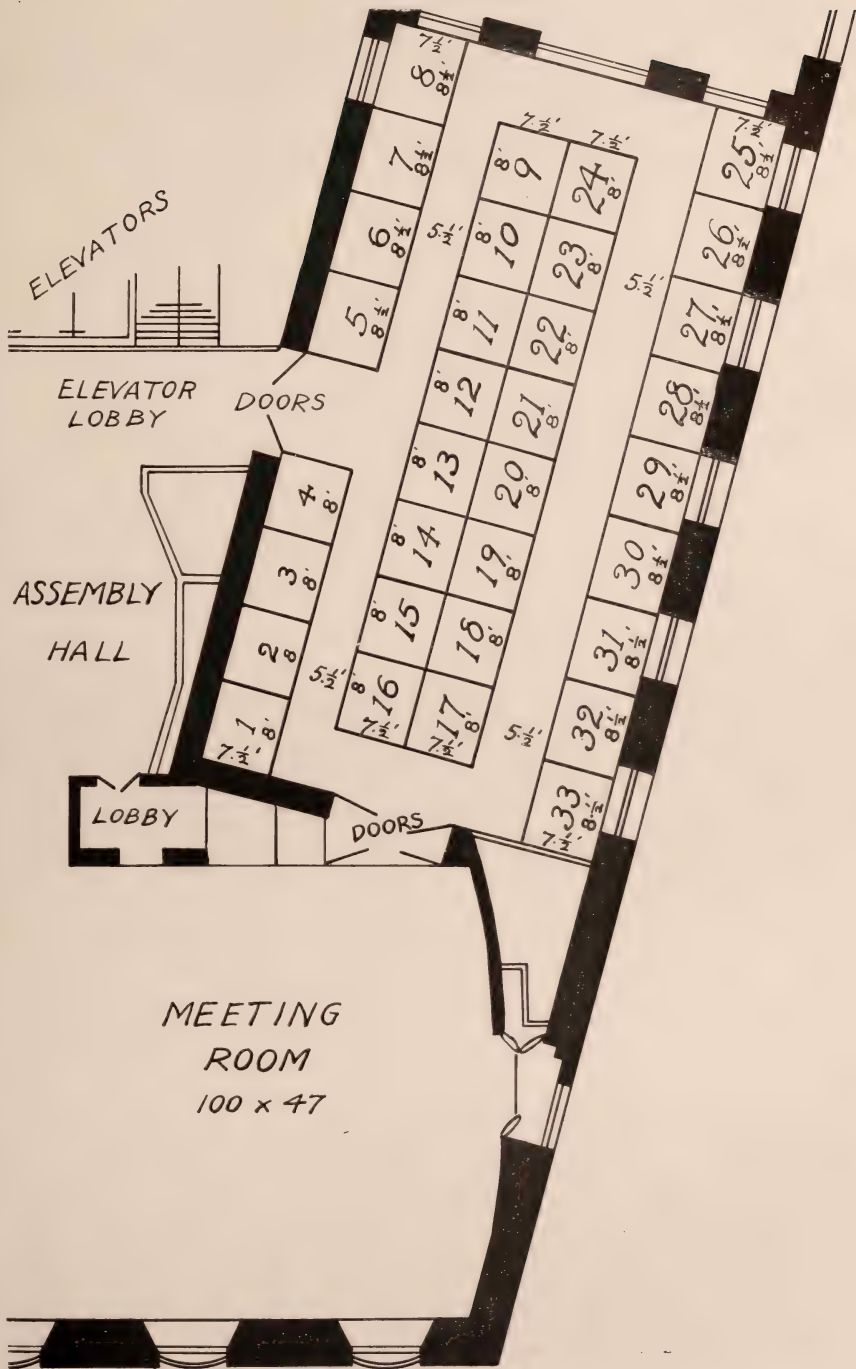
Several forms of very practical distance applicators will be shown, including a special form of eye cup to hold radium tubes or needles at a distance of approximately twenty-five millimeters. The distance applicators and eye cup are supplied with special sheet-metal screens of various thicknesses. A convenient screen of gold-plated brass, moulded to fit the contour of the eye may also be mentioned.

Among the general accessories will be included, Balsa wood for blocking radium away from the skin. It is an extremely light weight wood, highly recommended on account of the ease with which it may be cut to the required shape and also because it absorbs very little gamma radiation. A special grade of Kerr's Dental Compound, Bronze Ligature Wire for radium needles, sheet-lead in various thicknesses and special forms of pure rubber tubing will also be exhibited.

The above mentioned articles are some of the new accessories which, together with the other instruments that the company has regularly furnished its clients, will be demonstrated by representatives, who will be in attendance at booths twenty-five and twenty-six during the entire session of the Radiological Society meeting.

Space Nos. 27, 28 and 29—Acme X-ray Co., 341-51 W. Chicago Ave., Chicago, Ill.

Space Nos. 30, 31, 32 and 33—Wappler Electric Co., 162-84 Harris Ave., Long Island City, N. Y.



NEW EQUIPMENT

Adaptable Radium Applicators for Surface Treatment

THE equipment furnished by the Radium Company of Colorado includes a new form of radium plaque

handles or with a threaded boss to receive a straight handle measuring approximately 16 cm. in length. When

extremely thin monel which allows the beta radiation to escape outward along the entire boundary. It is claimed that this "fringe" of radiation is a distinct advantage in the treatment of large areas requiring several applications. The radiation extending outward from the boundary of the plaque serves to blend the result of one application into that of an adjoining area.

The sheet of monel only 0.1 mm. in thickness has been found to possess the strength necessary to protect the radium but the redmanol formerly employed is not strong enough unless a much thicker layer is used. In spite of the lower density, the thicker layer of redmanol absorbs more of the beta radiation than the very thin layer of monel metal. The intensity of radiation emitted from the new applicator is reported to be nearly three times greater than that of the old style plaque containing the same quantity of radium.

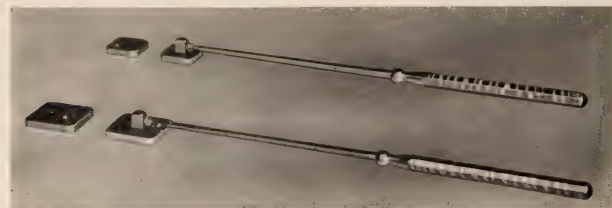


Fig. 1

and instruments designed to hold radium tubes or needles in dermatological applications. Probably the most radical change in design is the departure from the old style varnish or bakelite plaques. The new instrument

either in the flat back type without handles are furnished, they are made of the same material. The hexagonal handle may be detached from the small portion and threaded directly into the boss on the back of the plaque but generally if the handles are used at all, the full extension is desirable.

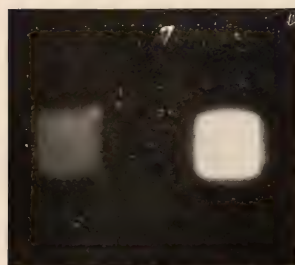


Fig. 2

which has been only recently developed in their laboratories utilizes an extremely thin layer of metal to cover the radium. The entire applicator is made of a non-corrosive alloy, called monel metal, and it may be obtained

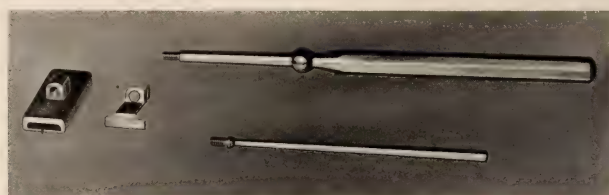


Fig. 4

(Fig. 1.) The face of the applicator is made of sheet monel metal only 0.1 mm. in thickness, beneath which the radium is uniformly distributed. The back of the applicator is thick enough to absorb practically all of the beta radiation, thereby providing suitable protection in that direction while the sides of the plaque are of

The difference in intensity is shown very clearly in the accompany illustration (Fig. 2), which was obtained by simultaneously exposing a photographic plate enveloped in opaque black paper to the radiation from the two styles of applicators, the monel plaque producing the more intense image on the right.

Figure 3 illustrates a new instrument designed to contain two glass tubes of radium beneath a thin layer of metal for surface applications, including tonsil treatments. The metal face of the plaque is of 0.1 mm. monel metal,



Fig. 3

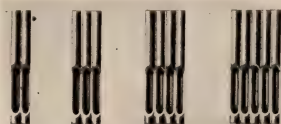


Fig. 5

similar to the applicator above described which therefore permits the operator to utilize the beta radiation with the exception of that absorbed within the glass walls of the tube and the very thin metal sheet. Approximately 50 per cent of the hard beta radiation is available with this amount of filtration. A similar instrument may be used to advantage in combining several radium needles (Fig. 4). The applicator shown in Figure 4 is provided with the same type of metal face beneath which the radium needles may be arranged side by side. A special form of cap which is held in position by

the handle serves to retain the needles or tubes in the desired position.

A convenient form of dermatological applicator is illustrated in Figure 5, which contains the usual radium needle in individual fenestrated compartments. The metal is completely cut away on one side of the applicator, directly over that portion of the needle containing the radium. Several needles may therefore be conveniently applied side by side with no metal filter except that of the metal walls of the needles themselves or by simply reversing the applicators, an additional filtration of 0.5 mm. of brass may be obtained.

Time Gauge for Photographic Developing

THE Vulcan Electric Company of Los Angeles, California, has just placed on the market a device known as a Time Gauge for photographic developing.

As will be observed by an examination of the accompanying illustration, taken from the letters patent, the purpose of this device is to measure the temperature of developing solutions in terms of the length of time a plate or film should remain immersed in order to accomplish good results.

The inventor of this instrument, Mr. H. A. Masac, sales manager of the Vulcan Electric Company, makes the statement that the scale of the gauge illustrated is especially adapted to x-ray negatives.

The gauge is illustrated as comprising a base (1) upon which is mounted a closed tube (2) terminating at its lower end in a bulb (3), the tube being positioned lengthwise of the base (1) by suitable brackets (4) and, preferably, being provided with a protecting casing (5) over the bulb (3). The tube and bulb are adapted to contain any suitable medium which is expansible proportional to temperature variations, such as mercury, for example.

Graduations are provided upon the base of the gauge along the tube (2), these graduations being adapted to indicate in terms of periods of time various temperatures indicated by the column of the expansible medium within the tube (2). In the present instance, and as illustrating a practical embodiment of the invention, the graduations shown at (6) may each be arranged to indicate a rise in temperature of one degree F, eleven of such graduations being, preferably, provided forming ten spaces so positioned as to indicate temperature changes from 60° to 70° F.

Each of these graduations is marked to represent a period of time comprising twenty seconds between adjacent graduations, the indications for this period of

time starting at three minutes and twenty seconds for the uppermost graduation which represents a temperature of 70° and extending downwardly therefrom to the lowermost graduation representing six minutes and forty seconds. The minutes represented by the graduations (6) are, preferably, marked upon the base of the gauge at said graduations at one side of the tube (2), and the seconds indicated by the graduation are, preferably, marked upon the base of the gauge at the opposite side of the tube (2).

Above the numerals representing the minute graduations the word "Minutes" or an abbreviation thereof is, preferably, marked upon the base of the gauge as shown (7), and similarly the word "Seconds" or an abbreviation thereof is marked upon the base of the gauge as shown (8) above the numerals representing the second graduations. The middle graduation of the series indicating a temperature of 65° F. and marked to indicate five minutes is, preferably, also marked with the word "Normal" as shown (9).

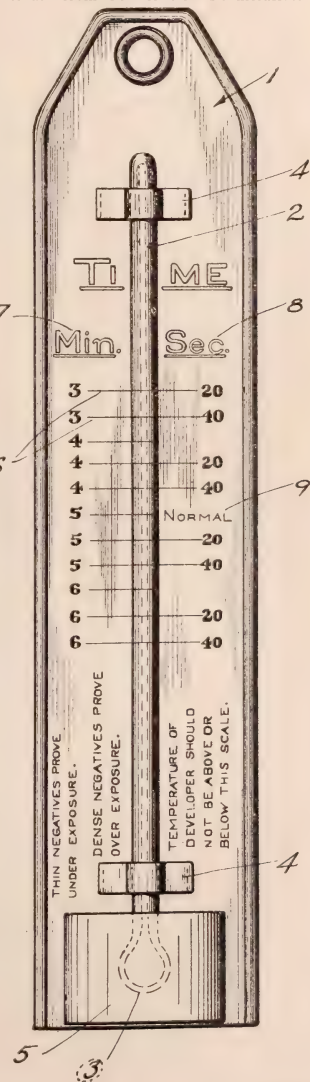
In use the gauge, as thus constructed, is adapted to be inserted in a developing solution which is to be employed for developing photographic plates, in the present instance x-ray plates. The temperature of the solution should always be between 60° and 70° F. inclusive and will therefore be registered on the gauge, and the length of time which a plate should be left in the developing solution will be indicated by the rising column of mercury upon the graduations of the gauge; the length of time which a plate should be left in the developing solution increasing conversely to the temperature of the solution from a period of time of three minutes and twenty seconds for a solution at a temperature of 70° F. to a period of time of six minutes and forty seconds for a solution at a temperature of 60° F. Thus, it will be seen that the proper length of time for develop-

ing a plate will be instantly shown upon the gauge when the latter is dipped in the developing solution without necessitating any computations.

Various changes may be made without departing from the spirit of the invention as claimed.

What is claimed is:

A gauge comprising a temperature responsive medium having a scale associated therewith and graduated from six minutes and forty seconds to three minutes and twenty seconds throughout what corresponds to a temperature increase from 60° to 70° F. inclusive.



The New Victor Stabilized Mobile X-Ray Unit

NUMEROUS requests have been made of all manufacturers of apparatus for stabilized units of one kind and another, each with a particular range of service.

The Victor X-ray Corporation believes it has achieved a unit which will meet these demands. It differs quite radically from other similar apparatus, primarily in that the stabilizer is incorporated in the unit as an integral part of its construction and added to this are such special features as circuit breaker, refined control, etc.

The range of service offered in this unit is readily comprehended when it is explained that it is designed to energize the "Radiator" type Coolidge Tube of 30 ma. capacity at a five-inch back-up spark.

Practically every electric current supply line is subject to voltage fluctuations, to some degree, according to the varying demands on the supply service every hour of the day. Every voltage fluctuation on the line has a corresponding effect on the operation of the Coolidge tube when the current in the latter is regulated simply through the ordinary filament control. Tests show that a 10 per cent change in filament current will cause a 200 per cent change in the

current at the tube; obviously, then, a slight fluctuation in the line supply during operation of the Coolidge Tube will seriously affect the end results, unless some intermediary device is introduced to compensate for this voltage fluctuation. The Victor-Kearsley Stabilizer does just that.

This device enables the operator to select the tube milliamperage desired and once the setting is made, this milliamperage—no more, no less—will be held constant during the entire period of exposure, regardless of voltage fluctuations which may be taking place on the line.

Summed up, the Victor Corporation announces that this unit is an absolutely dependable means of conserving time, energy and the expense of "re-takes." Predicated on the proposition that the operator's radiographic technique is correct, the stabilizer is the one and only insurance of obtaining the desired end result, that is, a radiograph of good diagnostic value.

The circuit breaker incorporated in this unit is developed to a high degree of efficiency. In case of "overload," that is, beyond the capacity of the tube, or short circuit or ground, the circuit breaker automatically shuts off the cur-

rent from the supply line, and so protects both the tube and the apparatus against damage which might otherwise result.

This device is important from the standpoint of protection to both operator and patient, in case of accidental

KVPs	MILLIAMPERAGE												INCHES
	2	5	10	14	18	22	26	30	35	40	45	50	
78	3.01	2.96	2.92	2.87	2.83	2.80	2.76	2.73	2.70	2.67	2.64	2.61	2
80	3.16	3.10	3.06	3.00	2.96	2.93	2.89	2.85	2.82	2.79	2.75	2.72	3
82	3.33	3.26	3.20	3.15	3.10	3.05	3.01	2.97	2.94	2.90	2.86	2.83	4
84	3.46	3.40	3.35	3.28	3.23	3.18	3.14	3.10	3.05	3.01	2.97	2.94	5
86	3.61	3.55	3.50	3.43	3.38	3.33	3.29	3.25	3.20	3.16	3.12	3.08	6
88	3.77	3.70	3.63	3.56	3.51	3.45	3.40	3.35	3.31	3.26	3.22	3.18	7
90	3.93	3.85	3.78	3.71	3.65	3.59	3.54	3.49	3.44	3.39	3.35	3.31	8
92	4.08	4.00	3.93	3.85	3.79	3.73	3.68	3.63	3.58	3.53	3.48	3.44	9
94	4.23	4.15	4.08	3.98	3.91	3.85	3.79	3.74	3.69	3.64	3.59	3.55	10
96	4.38	4.30	4.21	4.13	4.06	3.99	3.93	3.87	3.82	3.77	3.72	3.67	11
98	4.53	4.42	4.36	4.26	4.19	4.11	4.05	3.99	3.94	3.89	3.84	3.79	12
100	4.69	4.56	4.51	4.41	4.33	4.25	4.18	4.12	4.07	4.02	3.97	3.92	13
102	4.85	4.75	4.68	4.55	4.46	4.38	4.30	4.22	4.16	4.11	4.06	4.01	14
104	5.00	4.90	4.80	4.70	4.60	4.51	4.43	4.34	4.28	4.23	4.18	4.13	15
106	5.16	5.05	4.95	4.85	4.75	4.65	4.56	4.48	4.41	4.35	4.30	4.25	16
108	5.32	5.20	5.10	4.98	4.88	4.78	4.68	4.59	4.51	4.45	4.40	4.35	17
110	5.48	5.35	5.25	5.13	5.02	4.91	4.81	4.71	4.63	4.56	4.50	4.45	18
112	5.64	5.50	5.40	5.27	5.16	5.05	4.94	4.84	4.75	4.67	4.60	4.55	19
114	5.80	5.65	5.55	5.41	5.30	5.18	5.07	4.97	4.88	4.79	4.71	4.65	20
116	5.96	5.80	5.70	5.55	5.44	5.32	5.21	5.11	5.02	4.93	4.85	4.78	21

contact with the high tension system.

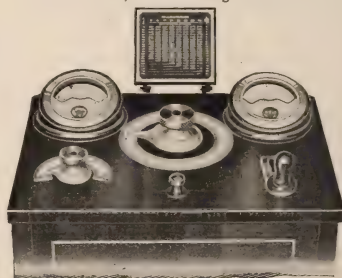
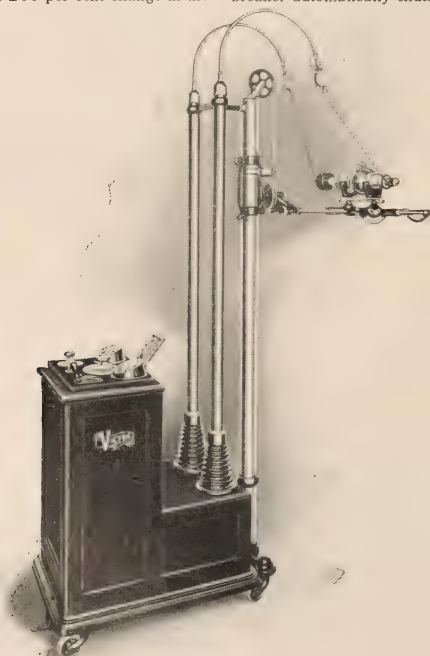
The Victor Unit offers a refinement of control that makes operation comparatively simple.

In the first place, the auto-transformer permits the selection *through one lever*, of any back-up spark over a range of three to five inches. This two-inch range is divided into twenty-six steps of penetration providing for the most exacting requirements of control.

The tube milliamperage is also under absolute control of the operator; simply by setting the stabilizer to any required milliamperage, from two to thirty, insures that exact milliamperage throughout the full period that the tube is being energized.

By means of the table mounted on the control stand the operator can determine instantly the voltage and reading and auto-transformer button required to obtain a given penetration and milliamperage.

The milliamperage chart readily conveys an idea of the practical design of this outfit, with the high tension trans-



former, filament transformer, stabilizer, and tube stand all in one unit. This compactness serves ideally where the physician is confronted with the problem of limited space. Hospitals will

find the apparatus applicable in many ways—as it is mounted on casters and is easily moved around to any part of the building for use at the bedside or in the operating room.

Another Wappler Combination

THE principal adopted by the Wappler Electric Company in the construction of the component parts of accessory apparatus is proving successful. This makes possible the assembling of various combinations for different purposes.

In applying this principle to the new Wappler Junior Horizontal Fluoroscope of which a description was given in the August issue of the *Journal of Radiology*, it was found very easy to attach a tubestand and a pair of high tension masts to the table. In this way there was an absolute high tension proof horizontal fluoroscopic and radiographic table. By simply moving the transformer to the head end of the table and changing the connections from the fluoroscopic tube to the high tension masts which connect to the tube in the tubestand above the table, the unit is ready for radiographic work. The transformer is of sufficient capacity to energize the 30 ma. tube and if desired a vertical plate changer either for stereoscopic chest work or stereoscopic work of the colon can be incorporated in the table. The screen arm is easily removed or can be turned sidewise so that it does not interfere with the manipulation of the patient. The tubestand slides along the entire length of the table and has all the flexible features of the Wappler counterbalanced tubestands which run on roller bearings.

This unit should prove very valuable in surgery for alternate examinations by fluoroscope. A few simple adjustments enable the operator to change from one method of examination to the other, and radiographs can be made rapidly and easily. The apparatus can be manipulated by any one and special training in radiography is not required.

Another feature of importance is

that it is impossible for any bystander to sustain high tension shocks which sometimes happens when clinicians are making fluoroscopic examinations and unconsciously come in contact with high tension current carrying parts of the apparatus.

As an apparatus, particularly adapted to use in the operating room and in surgical operations, this table has the valuable feature that a fluoroscopic examination can be extended over the entire body of the patient without the necessity of moving the patient. This is very often of great importance in cases of adjusting fractures or searching for foreign bodies. Thus, when the

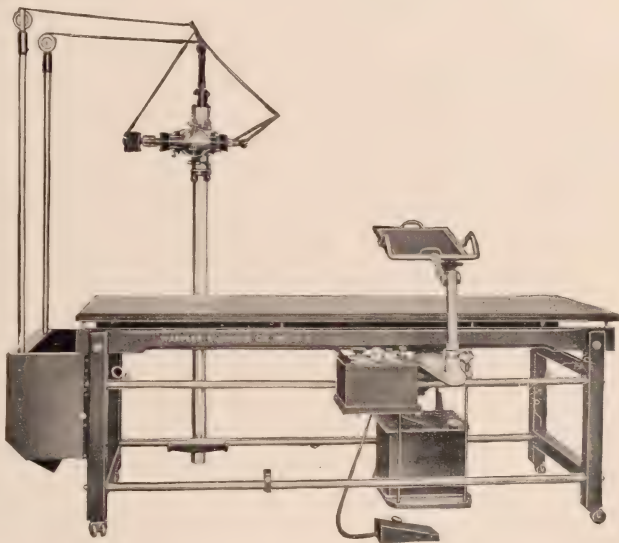
surgical operation is to be continued the fluoroscope screen is simply pushed out of the field and the operation resumed. If further fluoroscopic or radiographic examination is necessary, then with one motion of the hand either the fluoroscopic or the radiographic apparatus is placed back in position and another film can be exposed or the fluoroscopic examination and direct visible observation repeated.

Particularly distinctive features of this table are:

First: Extreme ease in changing from radiographic to fluoroscopic examinations.

Second: The entire length of the table is available for both radiographic and fluoroscopic examination of the patient.

Third: The absolute safety and extreme simplicity of operation of this apparatus render it very adaptable as a clinical or surgical radiographic and fluoroscopic unit.



ABSTRACTS *and* REVIEWS

The Value and Limitations of Roentgen Ray Diagnosis. Ernest H. Gaither, M. D., Jour. A.M.A., 79:618, August 19, 1922.

THE writer states that his experience of many years standing is the basis upon which he has written this paper.

He claims that in certain types of pathology of the esophagus, stomach, gall-bladder, liver, and intestines diagnosis without the roentgen ray is impossible; in other types it is merely confirmatory, and in certain others it is useless. He charges that many times it is absolutely mistaken. Because in his past experience he has too often found the x-ray findings mistaken, after he had accepted them against his better clinical judgment, he has now adopted a "more conservative and independent attitude."

In conclusion he says, "The ideas here presented are based entirely on personal experience and observation. I am not by any means decrying the use of the roentgen ray in the diagnosis of digestive disease, and my statements are not prompted by any condemnatory or critical spirit. In all fairness I must pay tribute to the splendid value and proved merit of this method of investigation. I desire, however, to caution the internist against the rapidly increasing habit of deferring his diagnosis until he has received the report of the roentgenologist. This endeavor to shift his responsibility to the shoulders of the radiologist bespeaks a spirit of unfairness, a shirking of duty, which augurs ill for the future of internal medicine. In this, as in all other fields of human endeavor, the best and most accurate results are to be obtained through cooperation."

The following points were brought out in the discussion by Drs. Mills, White, LeWald, Brown, Kessler, and Portis: Gastro-intestinal roentgen ray work is a highly skilled and difficult art, so far attained only by those few who have access to large material. Just as there has been a tendency to overestimate the value of the roentgen ray there is apt now to develop a tendency to underestimate it. Incompetent workers, both commercial and professional, have done much harm and some method of controlling this evil is necessary.

Under certain circumstances (e. g., in one of the St. Louis hospitals) exposures are made by the engineer and interpreted by the nurse-technician or a

physician with no special training or experience.

The x-ray diagnosis is not objective, but is a subjective interpretation of objective shadows. It is not the last word in diagnosis, but only one means of diagnosis to be considered in connection with other means. Roentgen ray diagnosis is often mistaken, but so is clinical diagnosis. Nearly every speaker insisted that the roentgen ray diagnosis must not be considered the ultimate dictum, but must be taken into consideration with other findings and that cooperation was necessary to the best results.

ERRATUM

IN the June issue of the Journal occurs an error in the abstract of the article, "Pneumoperitoneum" by Dr. Charles Martin of Dallas, Texas. Dr. Martin is said to have stated that Dr. Orndoff began the use of this procedure about 1917, and Drs. Stewart and Stein in 1919. The portion of this statement referring to Dr. Orndoff was not made by the author, but was inserted by the abstracter.

This correction is made at the request of the author.

W. W. W.

Roentgenology and Internal Medicine.

Lewellys F. Barker, M.D., Am. J. Roentgenol. 9:425, July 1922.

HIGH tribute is paid in this paper to the services rendered the internist by the roentgenologist. These two are the "draught horses" in the "modern diagnostic team."

The respiratory, surgical and digestive apparatus, the urogenital, locomotor, nervous and endocrine systems are the topics discussed under specific aid rendered by x-rays.

Speaking generally the author says that the roentgenologist who reports both the objective description of findings as well as their interpretation is the one who renders greatest service to the internist. The highest type of internist greatly desires this and both he and the roentgenologist will grow more rapidly in knowledge and diagnostic ability if such a course is pursued.

The writer states that more intensive and specialized studies are being made by roentgenologists but he stresses the great need for original research directed toward an improved technique and a more accurate interpretation of findings. Clinical studies, observation at

operations, and checking up at post-mortem should be part of the roentgenologist's program and in large centers roentgenologists should derive great benefit and contribute much to their science if they would organize in groups for original research.

Large hospitals and the universities should have a better understanding of the problems of the roentgenological department. Too often adequate funds are not provided for its use and frequently this department is expected not only to finance itself but to aid the other departments in their finances.

In the discussion following the reading of this paper Dr. Hickey expressed the gratitude of the roentgenologists for Dr. Barker's understanding, appreciation and cooperative spirit. Dr. Hickey said that many mistakes of the roentgenologist can be attributed to his being overcrowded—"The telephone rings for the diagnosis before they have finished the last part of the routine." On the other hand, the internist examines and re-examines his patients with no questions asked.

Dr. Christie said that it was important for both roentgenologist and internist to have a clear understanding of the limitations of roentgenology. The immense field which it covers can be adequately and creditably handled only if each follows some special branch.

Dr. Holmes emphasized the need of careful description and a better vocabulary in roentgenological work.

Dr. Barker in his closing remarks said that the internist was learning not to expect the impossible. Also he said that for an internist not to clearly recognize the difference between a roentgenologist and a picture taker was no longer excusable. There is need for both the general roentgenologist and the specialist in roentgenology according to Dr. Barker's views. Neither one he believes can be dispensed with.

Standardization of Roentgen Ray Reports. P. M. Hickey, M.D., Am. J. Roentgenol. 9:422, July 1922.

THE NEED for standardizing the matter of roentgen ray reports was brought very vividly to the author's attention upon his listening to reports recently submitted at a surgical congress. In order to ascertain the general character of roentgen ray reports he collected from members of the American

Roentgen Ray Society reports upon the examination of various parts of the body. His conclusions are embodied below. He wishes it distinctly understood that he is not criticising the diagnosis made, as their accuracy compared well with the pathological reports.

The roentgen ray report, viewed from the standpoint of form and accurate description is generally inferior to the pathologist's report. This the author attributes to the present inferior and inadequate methods of studying roentgenology in vogue in our medical schools.

The reports are too often lacking in scientific information of value to the surgeon or clinician and in many cases reports contain quite irrelevant matter, e. g., advice as to the treatment of a tuberculous patient. The lack of a standardized nomenclature also is a great detriment.

The author recommends that:

(1) "The American Roentgen Ray Society should make an effort to secure more uniform and better roentgenological courses in the medical colleges of the United States. (2) The American Roentgen Ray Society should recommend a standardized nomenclature to be used in writing roentgenological reports. (3) The American Roentgen Ray Society should foster a standardized type of roentgen-ray reports in the examination of different parts of the body for definite conditions. (4) The American Roentgen Ray Society should require of its candidates the submitting of one hundred roentgenological reports of actual cases written in conformity with the standardized nomenclature and recommended standardized form."

The X-ray Department of a Private Hospital. S. C. Barrow, M.D. Hospital Progress 3:324, August, 1922.

NO HOSPITAL today is properly equipped unless it possesses an x-ray laboratory manned by a competent chief.

For proper equipment modern apparatus for radiography, fluoroscopy, and radiotherapy are prime requisites. The apparatus must be suitably roomed from the standpoint of convenience and hygiene. The x-ray rooms should be on the same floor with and easily accessible to the surgical operating rooms.

The chief should be a radiologist and by this is meant not a mere technician but one who has graduated from a medical school of recognized standing, has practiced medicine at least two years, and has by special study and apprenticeship attained a reasonable

efficiency in x-ray work. Nothing short of these qualifications in the chief of the x-ray department is to the interest of any hospital. The employment of a cheap worker is both pernicious and unethical. X-ray interpretation is a specialty and cannot be mastered by a busy general practitioner or specialist in some other line, and much less can it be mastered by an incompetent medical man or one unqualified by medical training.

The x-ray department should occupy and fill a definite position in the hospital. With a properly qualified chief he, and no other member of the staff, is the one whose interpretation is to be accepted. The writer asserts that in nearly every case where x-ray findings are proved incorrect at operation investigation will reveal the fact that either the findings were made by an incompetent worker in the x-ray field or else that the surgeon or some other member of the staff has used his own interpretation of the plate instead of the one given him by the roentgenologist.

Cordial cooperation should exist between the x-ray department and the staff and if it is lacking no progress can be made. If the good of the patient and the advancement of science are matters of paramount importance to each worker then cooperation will naturally ensue. The radiologist should have the time and opportunity to be present at any operation which may be of interest to him and which may shed light on his work, and a little forethought on the part of the staff will result in his having time to work unhurriedly, which is a necessary factor in attaining the best results. It is suggested that a system of reporting operative, pathologic and x-ray findings would be found helpful. The first two should be checked with the x-ray findings, and discussion of these in staff meetings from time to time would be found profitable.

As to the ethical business arrangement between hospital and x-ray chief it should be the same as that between the hospital and surgical chief or other chief of any department. The fee for radiological service should be adjusted between the patient and the radiologist, and fee splitting with the hospital should have no place in the arrangement of the x-ray service.

Graduate Instruction in Roentgenology. J. S. Shearer, Ph.D., Am. J. Roentgenol. 9:459, August, 1922.

"**M**ERE observation will never fit men properly for work in roentgenology or in any other specialty." Instruction in the science of roentgenol-

ogy, Dr. Shearer believed, should be given the medical undergraduate, though in order to give it some elimination would have to take place along some line, as the medical curriculum is overcrowded at the present time. In some way, however, if the aspiring roentgenologist is to become a worthy member of the profession he must acquire a "general knowledge of normal roentgen-ray anatomy, a clear idea of the diseases in which roentgenization is likely to be of diagnostic or therapeutic aid, and some familiarity with negatives showing indisputable proof of pathology; but all this without wasting time in the effort to make roentgenologists of inexperienced medical students.

"The graduate intending to specialize in the use of this method should be provided with the opportunity to secure: (1) A knowledge of apparatus sufficient to enable him to judge of its necessity and worth. (2) Such knowledge of dark-room work as will prevent domination by a photographer or technician. (3) A clear cut knowledge of other methods of diagnosis in the lesions within his field. (4) As much gross pathology as can be secured. (5) Enough familiarity with operative surgery to enable him to know what information the surgeon needs, and the proper mode of expression. (6) Some familiarity with the main features of the historical development of his specialty. (7) Ability to judge of the relative importance of indications. (8) Such familiarity with the physical laws underlying the subject as will prevent him from publishing irrational papers or accepting them from others."

Instruction by salesmen of x-ray apparatus is an encroachment on the field of medicine that should never have been tolerated but has, instead of meeting disapproval, been welcomed all too often. Commercialism and the immorality of salesmanship is heavily scathed. "The law may forbid a layman to practice medicine but there is no bar to his undertaking to tell the doctor how dangerous agents should be used, or what is the dosage to be given. * * * Both the profession and those responsible for medical education owe it to themselves and to the public to find a remedy. * * * 'Free service' is a most expensive luxury. It must be charged to overhead or selling expense and some one foots the bill. The amount paid in this way would more than support proper instruction and provide for research."

The aggressive technician, unaware of his limitations, is another weight impeding the progress of the science of roentgenology. The writer believed the licensing of technicians to be es-

entially bad. "A state license is a dangerous tool in the hands of a small class, and gives no real guarantee of fitness. The only remedy effective against such conditions is in provision of such adequate means of instruction as will replace those of objectionable character."

Medical colleges, hospitals, roentgenologists, and possibly a special institute, must undertake the work of educating the coming roentgenologists if the science is to develop as it should and if it is to hold the honorable place to which its services, rightly rendered, entitle it. The intent to instruct must be dominant in the plan else it will be valueless.

Roentgenologists, even though they do not actually teach, can render great service by upholding the highest ideals of their profession and by at least urging instruction and research. Journals and society meetings can also lend their aid along this educational line. Atlases of normals of various ages and of well defined lesions should be available to the younger men just beginning their specialty. There is a largely uncultivated field here for service. Finally there should be a combined teaching and research institution where all problems of research might be worked out. The science of roentgenology is only in its infancy and a great and honorable work is yet to be accomplished in establishing its truths—a work which America might well be proud to lead and which she could lead if she would set herself to the task.

Graduate Instruction in Roentgenology.

G. W. Holmes, M.D., Am. J. Roentgenol. 9:465, August, 1922.

YOUNG men aspiring to enter the specialty of roentgenology should have special courses in physics, pathology, and anatomy as well as actual experience in the examination and study of cases roentgenologically, clinically and in the laboratory. In addition they should become familiar with roentgenological literature. Some special subject for study should be assigned and a thesis required. At least a year should be given to this special study although the author adds: "I realize that it is impossible properly to train a roentgenologist in one year's time. On the other hand, very few men, after their college and medical courses with a year or more of hospital training, can afford more than this period of time without a salary. As far as possible men graduating from such courses should be placed in positions as paid assistants to older men, from which positions, after a period of five years, they should be prepared to

take charge of a large laboratory or teaching clinic."

Shorter courses than the above are given (at the Massachusetts General Hospital) for general practitioners, not recent graduates, who wish to make some use of the x-ray in their work but who do not expect to make a specialty of it. Often the specialist in some other branch of medicine wishes to avail himself of such a course.

The Effects of Roentgen Rays and Radioactive Substances on Living Cells and Tissues. Leo Loeb, M. D., Am. J. Roentgenol. 9:497, August, 1922.

THE MORE important effects of roentgen rays and radioactive substances on living matter are: (1) There are intrinsic sources of radioactivity within the body. (2) The chief factors determining the degree of sensitiveness of living matter to radiation are given as follows: (a) Actively dividing cells are considerably more sensitive than resting cells and tissues. (b) Cells or tissues consisting of simple protoplasmic material in which a nucleus is embedded are much more sensitive than cells which are embedded in a large amount of transformed cell protoplasm or in products of cell secretion, fibers and paraplasmic material in general. (c) Especially resistant are entirely resting cells or tissues, especially if they have been dehydrated. (d) Tissues which are generally more resistant to all kinds of injury are likewise usually more resistant to radiation. (3) Radiation affects cytoplasm as well as nucleus. (4) There is a graded series of effects of radiation on cell functioning. The most delicate and intricate functions are affected by the smallest quantity of radiation. The coarser functions require larger doses. (5) According to the intensity of the radiation we may further grade the action of the rays. * * * Growth processes especially lend themselves to further differentiations of the actions of radiation. (6) These graded effects on growth are not peculiar to the action of roentgen rays and of alpha, beta and gamma rays. (Heat is here given by the author as an example of an agent producing a similar effect on tumor cells). (7) The intensity of radiation which is required for these graded effects varies with the sensitiveness of the cells and tissues upon which it acts. (8) A summation may take place between the effects of radiation and of unfavorable factors within the cell. This summation may convert an otherwise stimulating dose into a depressing one, or it may convert an otherwise depressing dose into a destructive one. (9) In the case of certain effects of radiation, a latent

period separates the time of application of the rays and that of the appearance of the first manifest consequences. (10) The effect of the various kinds of rays does not differ in a way corresponding with their fundamental physical differences * * * essentially the difference between the effects of the various rays is of a quantitative nature. (11) There are indications that through repeated radiations an immunization of tissues against the effect of radiation can take place." (12) Here the author states that everything so far said about tissues in general applies equally in the case of cancers which are especially vulnerable because they are dividing rapidly, often under abnormal conditions, and this rapid multiplication prevents or retards the production of paraplasmic structures in the tumor which would tend to protect the cells. (13) "The effect of radiation on tumors is primarily a direct one, acting on the tumor cells themselves. Only secondarily do the ingrowth of connective tissue and increased fibroids come into play. (14) There exist certain other indirect effects of radiation which may have to be considered in estimating the influence of radiation on tumors." Here the author discusses the increased and diminished number of lymphocytes in connection with x-ray effects. (15) "In appraising the effects of radiation on tumors we must, therefore, take into account the indirect effects of radiation which depend upon reactions of the host tissue against the tumor, as well as the direct effects on the tumor cells; among the former the connective-tissue reactions are probably of the greatest importance. Lymphocytes may play a certain role. It is furthermore possible that as the result of radiation the body fluids may be modified in such a way that growth processes are affected thereby. (16) The toxemia following radiation with a large dose of penetrating rays likewise represents an indirect effect. (17) Long continued stimulating action of roentgen rays and probably also of radium on previously normal tissues may convert these tissues into cancerous tissue, carcinoma or sarcoma."

Radium Therapy in Certain Benign and Malignant Conditions. Drs. Wm. D. James and Albert W. James, Southern M. & S., July, 1922.

IN THE treatment of malignant conditions in the several cavities of the body which communicate with the surface, radium is of much greater assistance to the surgeon than is the x-ray. Also on the skin surface, radium is usually preferable.

Of benign conditions, fibroids and fibromyomas of the uterus yield the most pleasing results, except in very

large tumors or pedunculated tumors, which are more amenable to surgery for obvious reasons. Four hundred milligram-hours in the uterine cavity for from four to seven treatments usually suffices for fibroid tumors.

Lupus vulgaris responds more readily to radium treatment than to any other procedure. Full strength radium plaques screened with one or two mm. of aluminum and three mm. of rubber should be used; the same applied to pigmented nevi. Moles should not be treated with radium unless they have become irritated, in which case they should be treated as cancerous.

In inoperable carcinoma of the breast and in recurrent carcinoma after radical operation, radium therapy is the preferable treatment. Heroic treatment over a long period of time is required. Pre-operative raying is also advised.

In inoperable carcinoma of the uterus, twenty-four cases have been treated; twelve cases have been discharged for treatment, to be kept under observation; four others are ready to be discharged.

Radium treatment in operable carcinoma of the cervix is a worthy rival of total hysterectomy; two such cases have been treated with clinical cure.

W. W. W.

X-ray and Radium in Superficial Lesions. Byron H. Jackson, M. D., Pennsylvania M. J. 25:707, July, 1922.

IN CANCER every malignant cell should be destroyed with cosmetic effects as a secondary consideration.

Keratosis, corns, warts, papillomas and keratomas can usually be removed in short exposures of full strength applicators.

Vascular nevi yield very readily. Cavernous nevi may be destroyed by careful dosage.

One case of lingua nigra has been successfully treated.

Metastatic nodules from breast cancer are best treated by radium.

In lupus vulgaris radium and x-ray are the two best therapeutic measures, radium being preferred when the lesion is accessible.

W. W. W.

The New Intensive Deep Roentgen Therapy and Its Application in the Treatment of Cancer. J. Henry Schroeder, M. D., Kentucky M. J. 25:463, July, 1922.

THIS paper is a presentation, before a general medical body, of the significance and clinical advantages of the higher voltage therapy by the homogeneous rays of Dessauer, their measurement by the iontoquantimeter, and the therapeutic application of the newer

ideas. Certain facts are emphasized:

(1) The complete cancer dose must be administered in as near one treatment as possible. An effective 100 per cent dose cannot be given in fractions.

(2) If cancer cells are not destroyed they will recover from the radiation, and if the dose is less than 40 per cent the cells may be stimulated to further growth.

(3) If too large a dose is administered, the adjoining tissue may be destroyed.

(4) To administer a complete radiation cancer dose may require from two to eight hours constant exposure, and if the patient's condition does not prohibit, this entire dose is given in one treatment.

(5) There is a certain effect upon the blood and Wintz is given as authority for the belief that failure of the blood to recover is the chief reason for failures to cure cancer.

If a full dose is given, it need not be repeated in less than six or eight weeks, as the tissue reactions are hardly completed before this time.

W. W. W.

General Consideration of Radiotherapy. John C. Graham, M. D., Long Island M. J. 16:328, August, 1922.

THIS paper written for the information of those practicing some other specialty or practicing general medicine, gives an unusually clear explanation of the fundamental physics of radium, of its actions on the tissues, and of its therapeutic uses.

A few statements are of special interest to the roentgenologist, for instance, Crile is here quoted as saying that aside from physiological rest surgery and the roentgen rays are the only therapeutic agents of use in thyroid disease. Pre-operative as well as post-operative treatment is advocated.

"Radiotherapy is in its infancy, but it has come to stay, as results may be accomplished with x-ray which can be obtained in no other manner. They do not fulfill the lay idea of a cancer cure, but they are adjuncts in a physician's armamentarium, and as such are of great use in many cases."

Electro-Coagulation Combined with Radiation in the Treatment of Malignant Disease. George E. Pfahler, M. D. and Bernard P. Widmann, M. D., Pa. J. Roentgenol. 4:7 (No. 3), July, 1922.

THIS paper was presented about a year after the one of similar title by the same authors (abstracted in the July number of the Journal), and contains additional information.

The disadvantages, as well as the advantages of electro-coagulation are summed up, technique is described, and cases suitable for treatment are described.

The disadvantages are that there is no chance of saving blood vessels or nerves in close proximity to the disease, and the sloughing of tissues with consequent disagreeable odor is, of course, a great objection. The open area left calls for plastic operation for correction. If heat penetrates into the periosteum of neighboring bone, local necrosis of the bone will result, and therefore this must be prevented by curettage of the bone.

The advantages are that there is complete destruction of the local malignant disease by heat, and there is the advantage of greater depth and a larger zone of heat because the heat is generated within the tissues and is not transmitted heat. Neither blood vessels nor lymphatics are opened and the wound heals with a smooth scar. Less tissue is sacrificed than by surgical treatment.

A general anesthetic is necessary for all but the superficial lesions and presents some difficulty, especially with regard to ether anesthesia, as the spark from the current may cause an explosion and the anesthesia has to be interrupted during the time that the electro-coagulation is in progress. The authors have used hyocine, morphine and cactin in combination, but the same objections hold true here as with morphine. Nitrous oxide is preferred whenever it can be used.

Warts, moles, keratosis, angiomas and basal cell epitheliomas can usually be cured by electro-coagulation, but sometimes a combination of methods is desirable with these lesions. Epithelioma of the lip and leukoplakia, also carcinoma of the bladder, are first treated by electro-coagulation and this is followed by filtered radiation in the case of the first of these and by radium and radiation from x-rays in the last two. Two exceptional cases of carcinoma of the breast have been successfully treated by electro-coagulation.

Roentgen Ray Treatment of Chronically Infected Tonsils and Adenoids. Charles A. Waters, M. D.; Paul B. MacCready, M. D., and Charles H. Hitchcock, M. D., Johns Hopkins Hospital. Am. J. Roentgenol. 9:469, August, 1922.

TWENTY-ONE cases of infected and hypertrophied tonsils and adenoids were treated with the x-ray to determine whether the same clinical results could be accomplished as in tonsillectomy and adenoidectomy, and to determine whether there was a per-

sistence of the carrier state. The discussion is limited to fourteen of these cases, as the records for the others are incomplete. The following excerpts are taken from the general conclusion reached by this study:

"Roentgenotherapy causes a decrease in the size of chronically infected tonsils and adenoids. * * * Our experience teaches that roentgenotherapy will not cause the hemolytic streptococcus to disappear permanently from the surface of the crypts of the tonsils, but will cause a small percentage of the palpable glands at the angle of the jaw to disappear. * * * Clinically, roentgenotherapy gives relief from symptoms, but this may be only temporary. * * * In some cases the objective signs do not disappear * * * although subjectively they are well. Generalized use of x-rays for treatment of chronically infected tonsils and adenoids is not advisable. Practically 100 per cent of chronic carriers of hemolytic streptococcus and diphtheria can be cured by operative removal of tonsils and adenoids. X-ray and radium treatment must be effective in an approximate percentage, and at the same time more comfortable than operation, and be associated with fewer complications. The x-ray treatment of tonsils and adenoids is especially indicated in those cases where a surgical operation is inadvisable. * * * It is our impression that the greatest field of usefulness will be in the treatment of children. Children rarely have a chronic infection of the tonsils comparable to that of adults. Their tonsils and adenoids are very cellular and of the type that responds most readily to roentgenotherapy. Their symptoms are largely due to hypertrophy of the lymphoid tissue in the throat and nasopharynx. It is possible that when the technique is perfected, roentgen ray or radium treatment will entirely supplant surgical measures in children."

The Present Field for the Use of the X-rays and Radium in the Treatment of Malignant Neoplasms. William S. Stone, M. D., Am. J. Roentgenol. 9:502, August, 1922.

BOTH radiologist and surgeon owe it to their patients to use any help which either branch of medicine may offer to the other. Neither can afford to disregard the other one. Operative treatment of cancer has not been supplanted by radium and x-rays, and its field of applicability has been limited to the earliest stages of the disease.

A review of the more than ten thousand cases of neoplastic disease presented to the author during the last seven years at the Memorial Hospital, New York City, leads him to the con-

clusion that x-rays and radium have a specific field of applicability.

There are such wide variations in the reaction of tumors of different types as well as of those of the same type that "sarcoma dose" or "carcinoma dose" is not judged an accurate or a scientific term, for no such specific dose exists.

The type of tumor, its size, extent and condition are all factors influencing the effects of radiation. Type and condition are the most important of these. The general state of the patient's health and the condition of neighboring tissues are also important factors.

With the above observations in view x-rays and radium have a specific field of applicability in "lymphosarcoma, metastatic teratoid tumors of the testicle, certain embryonal tumors of the kidney in children and a type of bone sarcoma recently described by Ewing as endothelial myeloma." Operation is rarely indicated in basal cell epithelioma, or rodent ulcer. Lesions of the lip, tongue, mouth, tonsil, larynx, etc., have been brought into the same group for non-surgical treatment during the last three years. Results in uterine cancer are cited as the most brilliant achievements of radium. Results in all other growths of the mucous membranes fall short of those mentioned above.

As to treatment of recurrent lesions Dr. Stone says: "There is the same necessity of early treatment in the early stage as there is in the case of the primary growth. Neither agent is applicable for the terminal period of the disease. It too often happens that instead of receiving morphine and good nursing care, the patient is dragged about in the forlorn hope of being helped by x-rays or radium. Both the surgeon and radiologist are responsible for these abuses."

In cancer of the breast pre-operative raying is much less popular than post-operative raying is, but the author believes it to rest upon a more scientific basis than the latter does.

The use of the x-ray and radium in primary bone sarcoma is in the experimental stage, but substantial progress is looked for here. Results in the malignant osteogenic tumors have been negligible. Giant cell tumors of varying types have yielded both encouraging and disappointing results and conclusions cannot yet be reached.

"The patient's interests are best conserved by obtaining the conjoined knowledge of both the surgeon and the radiologist. In fact, cancer therapy has become an institutional problem requiring more clinical experience and knowledge of surgical pathology to use physical agents than does the operation."

Efficiency in the Diagnosis of Neoplasms. William C. MacCarty, M. D., F. A. C. S., Surg. Gynec. & Obst. 35:209, August, 1922.

HERE are presented the results of a comparative study of pre-operative diagnoses of 2,100 carcinomas of the breast with actual pathologic lesions found at operation and checked by a surgical pathologist at the Mayo Clinic.

Irrespective of malignancy or benignity the percentage of positive pre-operative clinical diagnoses made was 78.5 of the whole number of cases. This left 21.5 per cent of doubtful or questioned diagnoses. In 50 per cent of these doubtful cases suspicion was expressed.

Classifying the diagnoses with respect to malignancy and benignity the following data appear: Percentage of positive pre-operative clinical diagnoses of malignancy correct, 94.5. Percentage of doubtful or questioned pre-operative clinical diagnoses of malignancy correct, 62.8. Percentage of positive pre-operative clinical diagnoses of benignity correct, 82.8. Percentage of doubtful or questioned pre-operative clinical diagnoses of benignity correct, 81.8.

The writer asks what is the solution in the doubtful cases and answers that it is the surgical pathologist, and that there is no other solution. Such a solution can and should be secured even though there are many possible difficulties in the way, all of which he enumerates and discusses. He does not regard removal of a sector for examination as detrimental.

"All that is lacking to make the diagnostic efficiency greater, in practice, is your encouragement in the making of surgical pathologists with the ideals which have been enumerated. If all surgeons were to spend the next five years trying to follow out the plan presented here we would be able to render the public service of which we might well be proud. If we do not, then we must go along in the same guessing fashion, which I know is not the desire of the majority of the profession. What has been said of the breast is quite as true of the other organs of the body."

The Diagnosis and Treatment of Toxic Goiters. Chas. J. Lemmon, M.D., J. S. Carolina M. A. 18:226, August, 1922.

"IT CANNOT be denied that certain patients improve and apparently recover under x-ray and medical treatment," says the writer but he adds that it is impossible to distinguish between those whom this treatment may benefit and those who should have surgery and that often valuable time is lost by using these agents. Crile is quoted as say-

ing that the greatest number of cures is obtained by surgical treatment.

The following is an excerpt of the author's summary: "Toxic goiters may be present without evident enlargement of the thyroid or eye symptoms" * * * They are frequent and they "may produce a great variety of symptoms often atypical and simulate many other diseases, such as tuberculosis, myocarditis, neurasthenia, menstrual disturbances, etc." * * * "The basal metabolic rate is of greatest importance in the differential diagnosis. Remember Plummer's simple classification of goiters into three classes: (a) colloid; (b) adenomatous; (c) exophthalmic. Remember further that colloid goiters occur in young people, rarely persisting beyond the age of 30, are not surgical, and respond to treatment with iodine and thyroxin. Adenomatous goiters rarely give trouble before the age of 30. Advise removal beyond this age. If associated with toxic symptoms advise immediate surgical treatment."

The Value of Basal Metabolism Determinations in the Diagnosis and Treatment of Hyperthyroidism.
Henry F. Stoll, M.D., Bost. M. & S. J. 187:128, July 27, 1922.

THE question is sometimes raised whether these determinations are necessary to the diagnosis of hyperthyroidism. Crile, it is said, feels his clinical judgment to be his best guide but not all men have this diagnostic acumen. To most men the borderline cases are very puzzling and clinical judgment by itself is entirely inadequate and unreliable.

The trustworthiness of the basal metabolic test, if it is carefully carried out with the best apparatus, is unquestionable, but careful technique is indispensable and while it is simple, "The simplification of the technique is dangerous when it makes it possible for the tyro to secure measurements, which frequently neither he nor his associates are in a position to interpret intelligently, and from which it is possible for him to draw deductions that are not only erroneous, but since they not infrequently make for or against operative procedure, may actually be of serious harm. * * * Unfortunately the intellectual training of the operator has by no means progressed as rapidly as has the simplification of the technique." (Benedict.)

Roentgen Ray and Tuberculosis in Infants and Children. Frederick W. O'Brien, A.B., M.D. and Forrest B. Ames, A.B., M.D., Bost. M. & S. J. 187:279, August 24, 1922

CRIFFIN says: If, therefore, tuberculosis practically always starts in childhood, as we must admit it does by the evidence given us by competent observers, the way to eradicate it is not by sanatorium care of adults, but by preventive care in childhood."

The summary of the author's study is as follows: "We have presented a supplementary group of 34 infants and children, studied from the standpoint of correlating roentgen ray and clinical findings. These 34 cases are added to 44 previously reported. From this new group and total of 78 cases we have found the following:

(1) "A complete total of 20 cases of definite chronic pulmonary tuberculosis in 78 children under 14 years of age, or 24 plus per cent. Ten, or 50 per cent, of these cases were in children under 10 years of age. * * *

(2) "Eight patients were examined in whose lung fields the roentgenogram showed typical markings consistent with pathology caused by tubercle bacilli. These cases were negative clinically. Inasmuch as the prophylaxis of tuberculosis is more and more being begun in childhood, the roentgen ray evidence of pulmonary involvement may safely be taken as a warning, and certain positive cases should receive more detailed attention and treated along preventive lines.

(3) "Ten cases from our old series were re-examined by roentgen ray. These cases were clinically negative, but had shown positive lung field markings in previous roentgenograms. Five from these ten showed changes consistent with progression of the pulmonary condition; two showed development of cardiac lesions.

"From these we conclude that serial roentgenograms should become a routine part of methods of procedure in the diagnosis and preventive treatment of tuberculosis in infants and children."

The Supernumerary Pedal Bones.
Morris I. Bierman, B.S., M.D., Am. J. Roentgenol. 9:404, July, 1922.

IT is only partly true that the tarsus, as is commonly taught, is composed of seven bones. There are in fact about three times this number though this fact is seldom mentioned in anatomies. These added bones used to be considered as sesamoid bones and are often referred to as supernumerary osicles, which is incorrect.

Research has proved that these bones were once constant structures. They are now lacking in the average foot but are still occasionally found when the center of ossification in the

embryo persists as a separate bone. They may have true joints, or a ligamentous attachment but more frequently they fuse with a neighboring bone or else are joined to it by fibrocartilage.

The following outline of the common bones of the tarsus and their accompanying, so-called, supernumerary bones is copied from the original and all but a very few of the bones are illustrated by x-ray pictures:

1. Astragalus: trigonum and the astragalus secundarius.
2. Calcaneus: os sustentaculi and the calcaneum secundarium.
3. Navicular: tibiale externum, supranavicular.
4. Cuboidum: cuboidum secundarium.
5. Cuneiforme primum: cuneiforme bipartitum.
6. Cuneiforme secundum: inter-cuneiforme.
7. Cuneiforme tertium: os unci (processus uncinatus cuneiformis), intermetatarsum, os vesalianum, os peroneum.

Bone Lesions and Their Treatment.
John H. Rishmiller, M.D., F.A.C.S., Journal-Lancet, July 15, 1922.

OUR modern diagnostic facilities, chiefly the x-ray, have so allayed the anxiety of surgeons in treating fractures that many are now just as eager to handle them as they once were to avoid them.

CASES

(1) Surgical neck of humerus: An oblique and impacted fracture, with outer sharp edge of distal fragment projecting through soft tissues. Operation ten days after injury, spiking the head of the bone in proper position. A 25 per cent disability six months after injury and a 12½ per cent disability one year from date of injury.

Radiographs and line drawings show the fracture immediately after injury, and after operation with the arm in aeroplane splint, and again just before operation for removal of the spike.

(2) Sliding inlay bone graft for non-union of tibia: Radiograph showed fracture of tibia four inches from upper articular surface, with displacement of lower fragment outward and backward. Injury on January 17th, with marked ecchymosis and contusion of leg and knee. After failure to unite, radiographs showing callus formation with fracture through the callus, bone graft was made on November 17th. Subsequent radiographs and tracings show the admirable results obtained.

(3) Depressed fracture of cranium and crushed arm: Fell while attempting to board moving train. No radiographs taken prior to operation. The depressed fracture was removed and the traumatic amputation dressed. Subsequent radiographs show the skull where bone was removed and condition of the arm stump.

(4) Open fracture at base of cranium: This fracture extended the lower two-thirds of the distance between the foramen magnum and the superior angle, shown in radiograph and line drawing. The precaution of keeping this patient in recumbent position in bed for two months, although he was apparently ready to be up in two weeks, is held responsible for his excellent recovery.

(5) Fracture of pelvis with rupture of bladder: Heavy timber fell on patient's back while he was lying on the ground. Injured May 25th. After proper surgical treatment of the ruptured bladder, patient was radiographed on June 1st, showing a perpendicular fracture through the posterior portion of ilium, with upward dislocation of the ilium on the sacrum; radiograph and line drawing shown. No attempt was made to reduce the fracture or dislocation.

(6) Strain of ligaments followed by synovitis of sacro-iliac joint: Patient injured on April 19th by fall. On June 1st, he was having severe pain through the lower back. Radiograph showed widening of right joint spaces. With a Goldthwaite belt he made perfect recovery.

(7) Acute metastatic osteomyelitis of tibia from oral sepsis, with radiographs showing the location of the metastatic abscess.

(8) Open fracture of femur, with radiographs showing position of bones and drains, and later radiographs showing extensive callus and strong bony union. W. W. W.

Diagnostic Value of the X-ray in Joint Diseases, with Case Reports. Vernon Blythe, M. D., Kentucky M. J. 20:480, July, 1922.

THE purpose of the paper is to give the x-ray findings, distinctive of the different disease conditions. These are classified into (1) those confining themselves to the articulating surfaces, and (2) those which begin in the articulating surfaces and then extend to the body of the bones.

In the first class there are described, infectious arthritis (acute and chronic in various stages), and the first stages of tuberculosis.

In the second class are described later stages of tuberculosis, destructive

conditions following fractures, Charcot's joints and syringomyelia. The signs of hemophilia and Perthes' disease are also discussed.

W. W. W.

Cancer of the Prostate. Hermon C. Bumpus, Jr., M. D., Surg. Gynec. & Obst. 35:177, August, 1922. A comparison of results obtained by radium and surgical treatment.

IN COMPARING results obtained by these two therapeutic agents logical conclusions are seldom arrived at for the reason that the unit of measurement taken is usually the number of patients surviving after a certain number of years, with no reckoning of their comparative general physical condition at the beginning of treatment. Those treated by radium are seldom in as favorable a general condition and therefore the conclusions so often arrived at without consideration of this factor are unjust to radiotherapy.

In a group of these cases studied at the Mayo Clinic there were 72 early cases, i. e., cases in which malignancy was not suspected until operation of a supposedly benign gland revealed it, and also including those operated on because of suspected malignancy. There were 77 advanced cases, i. e., the disease was so far advanced as to render clinical diagnosis certain. Surgical results in these two groups differed only slightly and the mode of operation seemed not to be a factor.

A comparison of all surgical cases (124) with all cases, except metastasizing ones, treated by radium (152) showed, during the first two years, 69 per cent of the surgical group dead and 83 per cent of the radium group dead—a difference of 14 per cent in favor of surgery. It must be noted here that those treated by radium were very poor risks because of their general physical condition while the others were in much better condition. The radium treatment in this group has been given within the last six years, while most of the operative work was done more than six years ago. Furthermore, it is only within the last three years that patients have been wisely selected and adequately treated with radium therapy.

Formerly it was believed that radium applied over the surface of the prostate either in the rectum or urethra was sufficient, and failure was attributed to inability to penetrate the mucous membrane with sufficiently large doses. To overcome this obstacle, needles containing radium were inserted through the perineum directly into the growth, and large doses were given. This resulted in necrosis and sloughing around the needles, but the periphery of the gland received but scant radia-

tion." It has been found that it is necessary to use all methods of application with minimal doses of radium and the number of points of radiation are as important as the dosage.

The author's conclusions are that: (1) "The results obtained thus far by radium in the treatment of cancer of the prostate are inferior to those obtained by surgery. (2) The new methods of radium application indicate that in the future the results of the two methods will be the same. (3) Partial prostatectomy in cases of carcinoma occasionally proves to be a curative rather than a palliative procedure. (4) A combination of radium and surgery offers the best results."

The Use of Radium in Bleeding from the Non-malignant Uterus. Russell T. Wall, M. D., Pennsylvania M. J. 25:711, July, 1922.

THERE are two kinds of bleeding, one caused by fibroids, and the other by hemorrhagic endometritis.

In fibroids, the indications for surgery in preference to radium are: (1) large tumors; (2) young women where sterilization is not desirable; (3) complicating pregnancy; (4) complicating infection; (5) toxic conditions indicating absorption of necrotic fibroids; (6) where diagnosis of fibroid is not certain; (7) associated surgical conditions.

The advantages of radium are: bleeding stopped at once, no fatalities and no irritating symptoms if precautions are observed, ease of application, no anesthesia, can be given at home if necessary.

In essential bleeding or hemorrhagic endometritis, the effect of radium is prompt and certain. A curettage for diagnosis is essential, as there is always a suspicion of malignancy. Sixteen case histories are given.

Treatment of Carcinoma of the Cervix and Uterus by Radium and Deep X-ray Therapy. Russell H. Boggs, M. D., Pa. J. Roentgenol. 4:5 (No. 3), July, 1922.

IN TREATING these lesions x-ray therapy should be used in conjunction with radium, applying as much radium as the local tissues will tolerate without irreparable damage.

Radium technique calls for knowledge and judgment which will follow only upon careful study. The number of milligram hours used depends upon "the extent of the disease, space in vagina, resistance of normal tissue, filtration, distance apart of needles or tubes" and whether these are buried in or simply applied against the growth.

Properly administered, radium results seem to equal those from hysterectomy in early cases and in borderline

or advanced cases they are superior to those resulting from operation. Inefficient treatment, however, is worse than none at all, but such treatment is all too frequent. Superficial workers are to blame for so many undesirable results. Radium and x-ray are no more mastered in a day than is surgery. The earnest worker is not the one to whom this criticism is directed. Familiarity with the physics of these agents is necessary for their mastery and should, in some way, be obtained.

It is not true, under every condition, that an erythema dose is a lethal cancer dose. The true lethal cancer dose has not yet been established and as yet there is no uniform technique established even in Germany.

Different radiologists differ considerably as to what constitutes an erythema dose—that of Seitz and Wintz is a mere reddening, while that of Warnekros is about twice the Seitz and Wintz dose and is too near the limit of permanent damage to be universally adopted.

The high voltage machine has come to stay, but it is not yet perfected and there is great danger attendant upon its use unless the physician employing it is a physicist or calls in the services of a physicist before attempting to use it.

X-ray Versus Surgery in the Treatment of Fibroid Tumors of the Uterus. Joseph Lane, M. D., Northwest Med. 21:241, August, 1922.

THE percentage of these tumors requiring treatment varies in different clinics from 25 to 90 per cent. Radical treatment is not indicated except when the symptoms are severe, and though some enthusiasts make ridiculous claims it is a fact that with improved technique the counterindications to the use of the x-ray for this lesion are diminishing. In many clinics surgery is now used only when there are counterindications to the use of the x-ray. These are cancer of the cervix or the body of the uterus in addition to the fibroid tumor, pregnancy, and youth or early middle age. Also all cases of ovarian or parovarian tumor, prolapsed uterus or hernia, pedunculated subserous or submucous tumor or a tumor reaching above the umbilicus should be operated upon. In exophthalmic goiter x-ray is also dangerous.

It is important in anemic cases that the clinician should have knowledge of the fact that the x-ray has a powerful effect upon the blood-forming organs and upon the abdominal tissues.

Surgery is contraindicated in nephritis, diabetes, certain neuroses and psychoses, myocarditis, the so-called

myoma heart, pulmonary tuberculosis, arteriosclerosis, chlorosis, and uterine hemorrhage of syphilitic origin and (by inference) exophthalmic goiter.

Myomectomy for Myomas of the Uterus. William J. Mayo, M. D., Northwest Med. 21:236, August, 1922.

PRESENT technique renders treatment of these tumors one of the best understood and safest procedures of modern surgery.

The menstrual cycle has a marked effect upon the female between puberty and the menopause and the nervous and psychic changes attendant upon the normal menopause are aggravated in young women by an operation which checks the menstrual flow. Whether this is brought about by removing the ovaries and leaving the uterus or vice versa makes no difference in the effects mentioned. Conservation of the ovary or at least a portion of it is of the greatest importance.

The mere presence of a myoma does not necessarily call for treatment. Needless operations are too often performed upon such cases and "many patients with small to moderate sized symptomless myomas are now having radium treatment; such patients require no treatment, but should be under the observation of their physicians." A prudent diagnostician can make a diagnosis of probable malignancy in time for curative operation.

Hysterectomy is seldom necessary for benign myoma in a woman under 35 and should be very, very rarely employed in a woman under 30. After 45 years of age it is probably the best procedure. When it is necessary for uterine myoma the writer believes in a total one. "The common indications for treatment of uterine myomas are hemorrhage, pressure, signs of malignancy and the size of the growth, the form of treatment being determined in a given case by the particular indication present."

As to radium and x-ray he says: "The Mayo Clinic has more than 200 milligrams of radium in use, and its roentgen-ray department is well organized for therapeutic work. Our experience with radium and roentgen-ray has been wide, and we have no prejudices. Roentgen-ray treatment for myomas is capable of producing results somewhat similar to those of radium, but it is less easily controlled and its effects are less direct and certain; the ovaries more than the uterine musculature are affected; with greater possibilities of harmful effect on the intestines and other abdominal viscera by the roentgen-ray. If the patient is approaching the menopause, especially if hemorrhage is

the chief indication for treatment, radium gives results so sure and so safe that it has no competitor and its use is indicated in patients whose general condition renders operation more than ordinarily hazardous, such as those with obesity and diabetes. If the patient is near the menopause, and has large tumors, especially if there is associated coincident disease of the ovaries or a suspicion of malignancy, hysterectomy is indicated.

"It has been argued against myomectomy that it is a more dangerous operation than hysterectomy, but the mortality in our series of 909 cases with seven deaths (January 1, 1891, to November 1, 1921), was a trifle under one per cent (0.7). In cases of abdominal myomectomy the mortality was 0.5 per cent. Vaginal myomectomy gave a death rate of 2.7 per cent on account of infection present."

Uterine Hemorrhage of Benign Origin Treated by Irradiation: An analysis of five hundred and twenty-seven cases of myoma uteri and myopathic lesions. John G. Clark, M. D., and Floyd Keene, M. D., Jour. A. M. A. 79:546, Aug. 12, 1922.

THE BEST interests of the patient demand that both irradiation and surgery be considered in determining treatment. Radium is, of course, chiefly applicable to these cases in the fourth and fifth decades of life, but with proper precautions it may be successfully used upon younger women.

In cases under twenty years of age it is very important to first exclude every possible contraindication to radium before direct intervention is determined upon. Not only this, but until the patient's health is manifestly deteriorating no form of intervention should be employed, for these cases often tend to self-correction under proper hygienic and medical treatment. If irradiation is employed the initial dosage must be very small and prolonged exposure should not be used. Fifty milligrams for from three to four hours is a safe dose if irradiation is not repeated until at least six months have elapsed. If a second application becomes necessary the time is increased from four to six hours, but not more. In the writers' experience not more than two applications have ever been necessary.

In cases from twenty to thirty-five years of age due consideration must be given to maternal possibilities and to the sexual life. Myomectomy is preferable in all such cases if it is possible. This will interfere with neither of the above functions while there is very little hope of a pregnancy after radiation. A subtotal hysterectomy with preservation of the ovaries is the next procedure of

choice. If radium must be used, then 50 mg. from six to twelve hours is the dosage approved.

After the age of thirty-five the above functions usually call for less consideration though surgical intervention is employed if the patient so wishes. Otherwise the writers' preference is for radium. In cases after the age of forty-five radium "occupies a premier position" for it is effective, gives quick relief, does not incapacitate the patient and no immediate or remote disabling sequelae need be feared. The writers feel that the latter statement is well founded in truth.

The stormy character of the menopause, whether artificial or natural, the writers believe depends more upon the temperamental and nervous stability of the patient than upon age itself.

Of the 527 cases treated by the authors, abnormal bleeding was controlled in 91 per cent of the 476 cases available for statistical study. There was one death which occurred from general peritonitis. A plastic operation upon the vagina, dilation, curettage and an intra-uterine application of 50 mg. of radium had taken place. These procedures were very soon followed by distress in the epigastric region, followed by a general peritonitis. Necropsy was not permitted and the cause of the peritonitis is unaccounted for.

In 23 cases abnormal bleeding was either slight or soon reverted to normal without subsequent treatment. In 28 cases subsequent treatment was necessary. Three per cent of all patients required operation subsequently.

Complications were confined to two cases of phlebitis and eight cases of a more or less severe neuritis. The latter is not unfamiliar in many cases of untreated menopause.

In conclusion the authors say: "We would commit a serious error were we to consider this splendid and most effective plan of treatment as a competitor of surgery. The two go hand in hand, and both must be supervised by the surgeon, and not by the roentgen ray expert or the roentgenologist, for each in a varying degree is a surgical measure."

Ante-Operative Radiation of Carcinoma of the Breast. Russel H. Boggs, M. D., Am. J. Roentgenol. 9:508, August, 1922.

POSTOPERATIVE radiation of carcinoma of the breast does not always yield the hoped for results, but the author believes that pre-operative radiation of these cases would greatly lessen the rate of recurrence. He questions whether operation should extend to the axilla if radiation and radium are employed. Groover, Christie, Merritt,

Sittenfeld, Quick, Holmes, Hernaman-Johnson and Pfahler are all quoted here in support of the author's judgment.

"The treatment of carcinoma of the breast by imbedding radium throughout the breast and the adjacent glands, preceded by surface applications of radium and heavy filtered x-rays makes radiation as thorough as amputation with the most careful glandular dissection. After such radiation removal of the breast may be indicated, but a radical operation may not be necessary."

Dosage and technique are fully discussed in the original paper.

Diagnosis of Early Breast Tumors. Based on Their Clinical Picture or Their Gross and Microscopic Picture at the Exploratory Incision. Joseph Colt Bloodgood, M.D., Bost. M. & S. J. 187:243, August 17, 1922.

DR. BLOODGOOD states that this paper has been presented to at least a dozen audiences and discussions following presentation lead him to emphasize the following conclusions:

1. "Examination should be made without any knowledge of the history or of the breast involved.

2. "Palpation is the essential feature. First to differentiate the indefinite from the definite single lump," and having found the latter to try in every way to recognize any palpable sign of malignancy. In the main discussion it is asserted that "more than ever before is the trained sense of touch required to differentiate between a definite lump, for which immediate operation is indicated, and an indefinite one which is simply part of a lumpy breast. Then when a definite lump is felt, the operator should be anxious to train his sense of touch to distinguish between the benign and the malignant tumor. In some cases this has been impossible."

3. Discusses gross appearance of blue-domed cyst and encapsulated adenoma.

4. Discusses gross appearance of scirrhus and medullary carcinoma, comedo-adenoma and colloid cancer.

5. Discusses non-encapsulated areas with or without minute cysts or dilated ducts. "I am inclined to the view, that as surgeons and pathologists learn to recognize the gross and microscopic appearance of the various stages of so-called chronic cystic mastitis as a benign lesion, they will be able to differentiate the nonencapsulated tumor of the benign adenoma type from the same lesion with areas of cancer. * * * Until they are able to do this all lesions should be treated as malignant."

6. Because of the great difficulties inherent in the differentiation of benign from malignant papillomatous the author contemplates a separate communication upon this subject.

7. Recurrence in the scar or its region is due either to bad surgery or late intervention, more often the latter.

8. Earlier intervention and good surgery is necessary if results of surgical operations for cancer of the breast are to be improved. Publicity is the key.

9. "The mistake that should never be made is an incomplete operation for cancer. The operation must never be in two stages.

10. "The mistake that cannot always be avoided is the complete operation for cancer in doubtful cases.

11. "When the surgeons of this country become as good diagnosticians as they are operators, I feel confident that the number of women who lose their breast unnecessarily will be reduced, and the number who are subjected to a complete operation for tumors that are not malignant will also be greatly reduced."

Tumors of the Breast from the Standpoint of the General Practitioner and the General Surgeon. Arthur Dean Bevan, M.D., Illinois M. J. 42:85, August, 1922.

MANY patients who seek the writer's advice for supposed cancer are found upon examination to have nothing that resembles a tumor. These cases call for careful study, nevertheless. The writer charges that many needless operations are performed upon just such cases; sometimes this occurs through an honest mistake and sometimes through unethical practice.

"Tumors of the breast are definite, tangible things, like a bean or an olive or an egg or an English walnut or an apple. It is not necessary to strain one's imagination * * * to determine the presence of a neoplasm if one actually exists."

The technique of the examination and the differentiation of benign and malignant growths from each other and from inflammatory processes is discussed at some length. There are other points to consider but the differentiation of a benign tumor depends largely upon the fact that "a benign tumor of the breast should be movable in the sense that when the mammary gland is held fixed with the thumb and finger a benign tumor can be moved in the mammary gland tissue itself." The usual description of malignancies given in the texts are of little value to any one except the pathologist.

The chronic inflammatory processes which may simulate cancer are actinomycosis, tuberculosis, and syphilis. The first of these is very rare, the second one is easy to differentiate, but syphilis is very deceptive.

The author finds about ten per cent of doubtful cases and in such cases he resorts to sectioning to which he can see no logical objection since "cancer cells do not hop around like the Irishman's flea." Neither does he believe that benign tumors are apt to become malignant in time.

The lymphatic drainage of the breast is described in some detail and the proper surgical technique described.

Permanent cure results in from 50 to 70 per cent of very early cases but in only 25 to 30 per cent when the whole number is taken into account.

These results the writer thinks can be improved by the x-ray of which he says: "I think the x-ray is of very much more value in the after-treatment of breast amputations for carcinoma than radium. I feel personally very strongly that it should be employed in every case, that it should be employed by an expert, and that it should be employed thoroughly, but short of any prospect of burning the patient. Time and again I have seen gross recurrent carcinomatous lesions, the size of a bean or the size of a cherry, disappear under x-ray treatment. It seems perfectly clear to me that if these gross visible, tangible lesions can be made to disappear under the x-ray that the microscopic group of cells from which they sprang could be very much easier destroyed if the x-ray is used immediately after radical operation. * * * And may I emphasize the importance of not only giving patients with cancer of the breast the benefit of proper radical treatment, but of also treating those patients with benign tumors not by radical but by conservative methods."

Histopathology of Cerebral Carcinoma. G. B. Hassin, M.D., and H. Douglas Singer, M.D., M.R.C.P., Arch. Neurol. & Psychiat. 8:155, August, 1922.

THE conclusions as set forth by the authors are: "(1) The brain lesions caused by carcinomatous growth are both focal and diffuse. (2) The focal lesions are due to direct invasion by carcinoma cells. The diffuse lesions are of the type of a toxic (non-infiltrative) encephalitis. (3) Reactive phenomena are mainly of connective tissue and may result in the formation of a demarcation zone. (4) In the absence of a demarcation zone a transition zone is constant and indicates destruction of the adjacent parenchyma

prior to invasion by carcinoma cells. (5) Propagation of the tumor takes place by infiltration and along perivascular spaces. (6) Reactive phenomena occur in the pia-arachnoid and in the choroid plexus."

Nasopharyngeal Fibroids Treated with Radium; Case Report. Samuel G. Dabney, M.D., Kentucky M. J. 20:461, July, 1922.

A CASE of fibroid of the nasopharynx, removal of which had been twice attempted without success, but with almost exsanguination of the patient, was treated by radium (Dr. D. Y. Keith) with entire atrophy of the growth and complete recovery of the patient.

Radium Therapy in Eye, Ear, Nose and Throat Work. Ricardo Fernandez, M.D., J. Philippine Island M. A. 2:116, June, 1922.

THIS is a report of six cases which included basal cell epithelioma, carcinoma of the throat, sarcoma of the nasopharynx, neurofibroma of the base of the tongue, trachoma, and cataract of both eyes with glaucoma.

These cases are all of about a year's duration, more or less, since treatment was instituted and all have shown improvement since treatment was begun.

The Advantages of Modern Methods of Diagnosis for the Dentist. Thos. B. Hartzell, M.D., D.M.D. Reprint from the Dental Cosmos.

SINCE dentistry has come to occupy the place it now does in the field of internal medicine it is necessary that the dentist have some understanding of medical problems.

It is not practical for him to look forward to attaining a medical degree as an aid to his dental practice since this would entail nine years of professional study, a thing which very few men would undertake, but the conscientious dentist feels his need of medical knowledge and would welcome some practical plan to attain it.

At the University of Minnesota a course of thirty lectures in medicine has been arranged for dental students by means of which they make the acquaintance of the common interlocking diseases which the dentist and physician need jointly to understand. In these lectures focal infection is treated in relation to general medicine, obstetrics, eye, ear, nose and throat, surgery, nervous and mental diseases, and chronic diseases of the lungs, heart and kidneys.

The writer suggests that certain subjects now taught in the dental schools be made entrance requirements and that

certain unessential subjects now taught in dental schools be eliminated from the course to make room for essential medical subjects.

A knowledge of the bacteriology, pathology and clinical treatment of clinical diseases would create a type of man who could and would cooperate with the medical profession in a way now impossible.

The Roentgen Examination of the Gastro-Intestinal Tract. F. H. Baetjer, M.D. Abstracted from Reprint.

THE author treats the subject in comprehensive and condensed detail throughout 20 pages of text accompanied by 40 illustrations. Owing to the teeming detail this abstract is more suggestive than complete.

The percentage of error in the roentgen diagnosis of the gastro-intestinal tract is greater than for any other part of the body. This is so because the tract is subject to many variations and may be affected by many causes, such as mental conditions, drugs, food, and reflex influences from other lesions not directly connected with the tract. Also there is no such thing as a fixed normal. Every patient is a new problem whose variation from a hypothetical normal must be ascertained. All these things lead often to mistakes. Considering that the roentgen diagnosis of gastro-intestinal disease has been in existence only a little more than ten years the progress made is not discouraging but is rather astonishing and each year witnesses further progress in the exactness of this method.

The roentgen interpretation should be made, not by the clinician, but by an independent observer. However, should the roentgen interpretation vary completely from the clinical findings the latter should have more weight in final diagnosis.

Roentgen examination of the gastro-intestinal tract should be made "in all cases where cancer or ulcer is suspected; where there is a long history of digestive disturbance, and particularly in cases over 40 years of age"; the latter group is included because cancer is so common after that age.

Both plate and fluoroscope should be used, as each supplements the other. The same type of meal should be adhered to because variations in this will cause variations in the activity of the stomach. Activity will be affected also accordingly as the stomach is presented fasting or full at the time the meal is given.

The fluoroscope is the better means of studying the esophagus. If the separate swallows of barium tend to run

together then the point of slowing up must be especially studied. This delay will be due to either spasm or to stricture. Evanescent spasm is of no significance but marked dilatation is an important sign. In this form the entire circumference of the esophagus is involved, and will present a V shape with the apex pointing downward toward the center of the lumen. On the other hand, stricture, if it is real, occurs in the wall, and if a lumen is present it will be at one side. In the very young stricture is apt to be the result of a burn but after youth it is generally the sign of carcinoma, or perhaps of a syphilitic lesion which is very difficult to differentiate from carcinoma until after antisyphilitic treatment has been given.

In the stomach, adhesions present the greatest source of error in diagnosis. In the author's experience the error in a series of 1,000 cases was from 20 to 25 per cent. "Very early carcinomatous lesions of the pylorus and lesser curvature cannot be differentiated from those of benign ulcers, while any lesion in the greater curvature is almost invariably malignant."

Roentgen examination is valuable in determining proper functioning after a gastro-enterostomy and also to determine the effect of medical treatment of gastric ulcer. In the latter cases peristalsis should return to normal after healing.

The last half of the original paper deals with the examination of the small intestines, the colon and the appendix. Tuberculous lesions are included in the discussion.

The Rectosigmoid Apparatus. Horace W. Soper, M.D., *Am. J. Roentgenol.* 9:412, July, 1922.

MAYO says the rectosigmoid apparatus consists "of three and one-half inches of the intestinal tract, which includes the terminal two inches of the sigmoid and the proximal one and one-half inches of the rectum." Next to the stomach and duodenum it is the most frequent site of pathology in the entire gastro-intestinal tract.

Mayo and Hurst, the author states, have both concluded that the rectosigmoid apparatus is a mechanism which retards the fecal current and which prevents the continuous progress of the intestinal contents into the rectum.

The writer's study of both normal and abnormal patients by means of the sigmoidoscope has led him to conclude that only slight traces of fecal matter, if any, remain in the rectum after normal defecation; and that the normal rectosigmoid apparatus includes from two to three inches of the bowel and

alternately contracts and dilates at the same time with the respiration; that normal cases have considerable variation in the tonicity of the contracture but that a five-eighths caliber tube can always be passed through it; that normal cases prior to defecation in the morning have the fecal column just above or just engaging the rectosigmoid area and that formation of feces occurs in the iliac colon.

Pathology and treatment are both briefly discussed and it is noted here that Mayo, in 100 consecutive operated cases of cancer of the rectum and the rectosigmoid, found that 63 per cent of the growth involved the rectosigmoid, 30 per cent the rectum only, and 7 per cent the anal canal.

Both fluoroscopic and plate methods are disappointing when used to visualize the rectosigmoid apparatus. "Inconstant and ever-changing anatomic relationships make it impossible to establish normal standards" by this means, and sigmoidoscopy is the only reliable method although the author adds that he has sometimes obtained good views by means of first insufflating bismuth subcarbonate with patient in knee-chest position and afterwards taking the plates with patient in dorsal position.

Numerous illustrations accompany the original.

Editorial. *Am. J. Electroth. & Radiol.* 40:257, August, 1922.

THIS editorial calls attention to the fact that the ultraviolet rays must not pass through glass if they are to have any therapeutic effect upon the patient. Attention is called to the following quotation from Professor Alfred E. Hess of Columbia University: "I did not realize how little this physical phenomenon is appreciated by physicians until the other day when present at a consultation in which several of the leading consultants of this city took part. These physicians, who must be considered as exceptionally well posted, had been treating a child for weeks with heliotherapy, and were surprised to hear that the treatment must necessarily have been ineffective, and invaluable time lost, in view of the fact that the windows were closed during the treatment."

The Effect of Ultraviolet Rays on the Calcium and Inorganic Phosphate Content of the Blood Serum of Rachitic Infants. Frederick F. Tisdall, M.D., *Canad. M. A. J.* 12:536, August, 1922.

"EXPOSURE of rachitic infants to ultraviolet rays from a mercury vapour quartz lamp, for very short

periods, caused a marked increase in both the calcium and inorganic phosphate content of the blood serum. The increase in the calcium and inorganic phosphate content of the serum was followed by clinical and roentgenographic evidences of healing. No increase in the serum calcium and inorganic phosphate was obtained by prolonged exposure to the rays from an ordinary 500 watt incandescent lamp."

Quartz Light Therapy in Skin Diseases. E. Lawrence Oliver, M.D., *Jour. A. M. A.* 79:625, August 19, 1922.

THIS paper gives an explanation of the physics of ultraviolet light and sketches the history of its therapeutic use. The author sums up his paper in the following paragraph:

Quartz light is of great value in many ulcers, especially those due to poor circulation. It is of great value in the port wine type of vascular nevus and in alopecia areata. It is often a help in the treatment of psoriasis. In localized chronic eczema with infiltration of the skin, it may prove of great value. In acne vulgaris, though the light is beneficial, improvement is usually only temporary. In lupus vulgaris it is sometimes curative. In lupus erythematosus, it may cause temporary improvement.

In the discussion following the reading of this paper varicose ulcer and pityriasis rosea were added to the list of amenable lesions. It was also stated that roentgenological treatment was far superior to the quartz lamp radiations and applicable in a far wider field. To this latter statement Dr. Oliver replied: "The roentgen rays are more valuable and more cases can be treated successfully with them, but the indications are different, that is, the ultraviolet light may succeed in cases in which roentgen rays are not indicated, and vice versa." Dr. Oliver in closing also mentioned the fact that the patient should be told beforehand if a severe blistering burn was contemplated.

Comparisons Between the Therapeutic, Photographic and Ionization Effects of Ultraviolet and of Beta Radiations. L. H. Clark, B.Sc., and B. D. Waters, B.Sc., The Physics Department, Middlesex Hospital. *J. Roentgen Soc.* 18:119, July, 1922.

THE main object (of this study) has been to find out whether there is any connection between one biological effect of these radiations and two important physical effects to which they

give rise, namely photographic action and ionization."

Exposure of the skin to either of these types of radiation results in effects varying from a faint reddening to ulcer formation. There are also marked differences in the effects of exposure from these two different types of radiations.

A mercury arc, enclosed in a quartz vessel was the source of the ultraviolet radiations used for purposes of comparison in this study. The current was derived from a set of secondary cells from which any potential difference up to 200 volts could be obtained.

"It was found that as the energy consumed by the arc lamp increased, the latent period decreased and the reaction changed from one in which there was only a temporary blushing of the skin to another in which the irradiated skin ultimately peeled from the arm." Under the conditions of the experiment the quantity of radiation received by the skin depended upon the time of exposure and the voltage between the arc terminals. "It would appear that, for a given distance between the skin and the arc lamp, the energy consumed by the latter during any given exposure may serve with fair accuracy to measure the probable extent of the resulting skin reaction. This parallelism between the energy consumption of the arc and the degree of skin reaction resulting from exposure to the radiations of the former is put forward with considerable reserve."

Upon comparison with the effects of the radiations of beta rays it was found that there was a striking difference in the time required for an erythema action to occur. This period was under five minutes in the case of exposure to ultraviolet rays and about seven days in the case of exposure to beta rays. A 24 mgm. capsule of radium bromide with an aluminum screen was used in obtaining the data for comparison. "The duration of the latent period in the case of ultraviolet radiation forms a rough means of estimating the degree of the resulting skin reaction. However, the differences in the latent periods resulting from widely differing exposures to beta rays are too small to be useful in this connection." This marked difference in the latent periods resulting from the two forms of radiation must be considered in arriving at any theory as to the nature of the processes involved in a skin reaction.

Upon the day of exposure to ultraviolet radiation the resultant erythema could be made to disappear by simply stretching the skin irradiated. The next day this revealed a pigmented skin although the red color could be made to

disappear. It was also an interesting fact that in ultraviolet light the irradiated skin ceased to fluoresce so strongly as the normal skin and this loss of fluorescence persisted for several months.

The experiments to secure comparisons of the skin reactions with the photographic actions of beta rays and ultraviolet rays led to the following conclusions: "It is clear that the photographic plate, sensitive as it is to the whole gamut of visible and ultraviolet radiations, fails to discriminate between those radiations which excite an erythema reaction and those which are inactive towards the skin * * * the photographic tint method, as practiced in the case of beta ray treatment, is unsuitable as a means of indicating the skin reactions resulting from exposure to sources of ultraviolet radiation.

"As is well known the ionization produced in air by beta rays is the method *par excellence*, for the determination of the therapeutic efficiency of a source of beta radiation. * * * A comparison between the ionization currents due to these two types of radiation shows that the electroscopic effect due to the radiation from 1 sq. cm. of the mercury arc is only 0.75 per cent of that due to the radiation from the same area of the radium source. Hence one may conclude that the ionization in air, caused by radiations from a quartz mercury arc, is negligible."

Experiments upon the photo-electric action of ultraviolet light makes it appear "that in the photo-electric activity of a metal surface under the influence of ultraviolet light we may have a powerful method of measuring the therapeutic effect of these radiations. There is, however, a serious objection to this application of the photo-electric effect. The metal surface is subject to fatigue, the practical effect of which is that electroscopic readings for identical conditions vary with time and with the degree of polish of the metal surface. If the laws governing these variations in activity were known it is possible that objections to the method might be removed. Research in this connection is proceeding at the present time."

A few simple experiments were made upon dried human skin and upon the living subject to determine the photo-electric action of ultraviolet radiations upon the human skin but the connection between the skin reactions and the photo-electric effects is still unsolved.

"It is clear from the comparisons which have been made, that, whereas, there are two important physical methods whereby the activity of beta rays may be determined, there is no accu-

rate method of measuring the therapeutic activity of the ultraviolet radiations from a quartz mercury arc. The method of estimating exposures of the skin to ultraviolet radiation in terms of the energy consumed by the arc during the period of irradiation, which was put forward at the beginning of this paper, is at best only approximate. There is an urgent need therefore for some accurate method of measuring the efficiency of sources of ultraviolet radiation, which are used for clinical purposes."

Violet Ray in the Treatment of Variola. Pasquale Romeo, M.D., Boston. M. & S. J. 187:215, August 10, 1922.

THIS paper describes most remarkable results following upon the use of the ultraviolet ray in three cases of small-pox.

In one particularly severe case, in which the suffering produced by the vesicles was excruciating, immediate relief and comfort followed the initial application (three hours to the whole body), and within twenty-four hours after this treatment a marked improvement in the clinical picture occurred. Treatment was continued for six days, the pustule stage was aborted, and practically no marks remained.

Equally satisfactory results followed treatment in two other cases. In these cases three Menin lamps of 110 voltage were placed on a stand so that one lamp radiated the face, chest and arms, another the abdomen and hands, and a third lamp radiated the thighs and feet. The lamps were kept from five to nine inches from the surface of the body accordingly as the patient could bear the heat. The patient turned from side to side as the heat became uncomfortable at this distance and during sleep the lamps were moved farther away. Treatment was given as often as the patient's comfort demanded it.

The writer believes that the earlier the ray is used the shorter will be the course of the disease and the milder the symptoms.

Principles and Practice of X-ray for Diagnosis. John A. Metzger, M.D., Roentgenologist to the School for Graduates of Medicine, Medical Department, University of California, Southern Division, Los Angeles. Octavo, pp. 144, illus. 61. St. Louis, Mo. C. V. Mosby Company, 1922. Cloth, \$2.75.

THIS is a comprehensive treatise upon the technique of x-ray photography and makes no pretense of going into the detail of any other phase of roent-

genology. The author states that his "aim in the preparation of this book is to put into the hands of the student and operator a formula on which to base his work in order that he may obtain better results and thus be able to reach a more correct diagnostic interpretation."

The chapter headings are: The Laboratory and Appliances; Stands Tables and Target Adjustment; Standardized Positions; Spine and Pelvis; Clavicle, Scapula, Sternum and Ribs; Technic for the Extremities; Alimentary Canal; Liver, Gall-Bladder and Genitourinary Tract; Stereoscopy and Localization;

Dental and Oral Radiography; Developing Room Appliances and Technic.

There are 61 original illustrations and these as well as the typographical appearance of the book are excellent. Its usefulness far exceeds its modest price.



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The Inheritability of Spontaneous Cancer in Mice and Its Application to Cancer in Man*

Studies in the Incidence and Inheritability of Spontaneous Cancer in Mice

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A PROBLEM in heredity is not a simple problem. The layman, both scientific and unscientific, is accustomed to think of the offspring of two individuals as being an inheritance compound of the qualities of these two only, with emphasis perhaps upon the characters of the one or of the other, forgetting that *behind each parent lay a long ascent of determining ancestry*. Unless, therefore, an individual is the product of generations of inbreeding of other individuals bearing characters exactly similar to his own, he is a heterogeneous complex of what he can transmit to his immediate offspring in any cross.

There are constantly appearing in scientific and medical journals today, both in this country and abroad, articles on the inheritability of some disease or pathologic condition, based on a study of the diseases of the immediate parents only. The conclusions of the authors for or against the heredity factor in any given pathologic condition is based on this study of the parents alone, whereas the slightest acquaintance with the basic laws of heredity would show that such a limited investigation makes a correct conclusion impossible.

The long continued process of mixed hybridization, typical of the human race, makes a problem difficult of analysis. With our present complete lack of scientific data concerning the ancestry of any human individual, the problem of the inheritability of any disease whatever is a problem impossible of scientific solution by the use of human statistics. This present impossibility of solving the problem by

the use of human statistics in no way influences the inevitable operation of the laws of heredity in the human species as exactly as in any other species.

Because, therefore, we have no scientific data with which to study the problem of heredity in the human species, nor any possibility of the collection of such data at any period in the near future, it is necessary that the facts of heredity and its method of operation should be studied by means of animals in the laboratory, where it is possible to establish a complete biologic control, and absolutely to isolate thereby the single factor of heredity. This latter can in no measure be done in regard to any subject whatever in the present status of human statistics.

The problem of the nature and inheritability of spontaneous cancer has been under study in this laboratory for the past twelve years, and for ten years the results of these studies have been in published form. During this time a more complete and more fundamental mass of facts has steadily accumulated, as it has been possible to analyze strains and individuals more and more completely.

One of the facts consistently demonstrated in these studies is the inheritability of spontaneous cancer, with its strong evidence against the possibility of cancer being a specific germ disease. Among the many thousand mice bred in this laboratory and the hundreds of strains derived thereby, there has been no case which does not agree with this conclusion, no appearance of spontaneous cancer in any non-cancer strain, nor any line into which cancer has been bred where it has not appeared in exact accordance with the known laws of heredity. The inheritance behavior of cancer has consistently been that of a simple Mendelian recessive, and at the same time, the behavior of the non-cancer tendency has consistently been that of a simple Mendelian dominant. It is therefore a demonstrated fact that spontaneous cancer is inheritable in

mice, and this fact is now pretty generally conceded.

The profound and biologic aspect of this demonstration, however, has for the most part failed to be grasped by the medical world, and the object of this paper, therefore, is to emphasize that phase of the study, and to make clear the exact application of this demonstration to the problem of the inheritability of cancer in man.

Every instance of organic behavior is based on biologic law. It is contrary to every biologic analogy to say that because we have not yet discovered it, there is no law for any given type of organic behavior. Many of these laws and their ramifications are as yet not even foreshadowed. In the case of the law of heredity, however, which is the most fundamental and most potent of all biologic laws, we have the fundamental facts. But although we have these facts, we continue in personal opinion and in actual practice for the most part entirely to ignore them.

What is heredity? If you consult the dictionary you will get some such definition as this: "Heredity, the law according to which plants and animals inherit and transmit from generation to generation certain characteristics or tendencies." But if we give it its full biologic definition, we must say: "*Heredity is the force which makes and holds together the genus and the species.*" It determines that fish shall have fins, and a special apparatus to filter air out of water, and for the specific fish it determines a certain arrangement of scales, a given size, a given egg-laying habit, as of the bass, the brook-trout or the salmon. It determines that insects shall have a given type of segmentation like the ancestral form from which they are derived, and for the specific insect it determines a given larval and a given adult form, as has the monarch butterfly, the sphinx moth, the honey bee.

It goes far deeper than this, and determines that the human embryo, be-

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gining with a single cell, like any unicellular animal or plant, shall divide in the same way, and in its complex cell division and differentiation recapitulate in hurried fashion the history of organic evolution.

Why? Let me here state, as I have already stated in a previous article, what I conceive to be the biologic law of heredity, the law which underlies all life: *That which goes into the germ plasm must come out in the offspring.* We must conceive of this simple law as being as absolute and as immutable as a fundamental law of physics: what goes up must come down; or a law of chemistry: sulphuric acid on zinc will produce zinc sulphate. If you pour acid on metal you will get a given reaction whether you want it or not. What goes into the germ plasm comes out in the offspring whether you want it or not—a law of nature, immutable, deaf to entreaty.

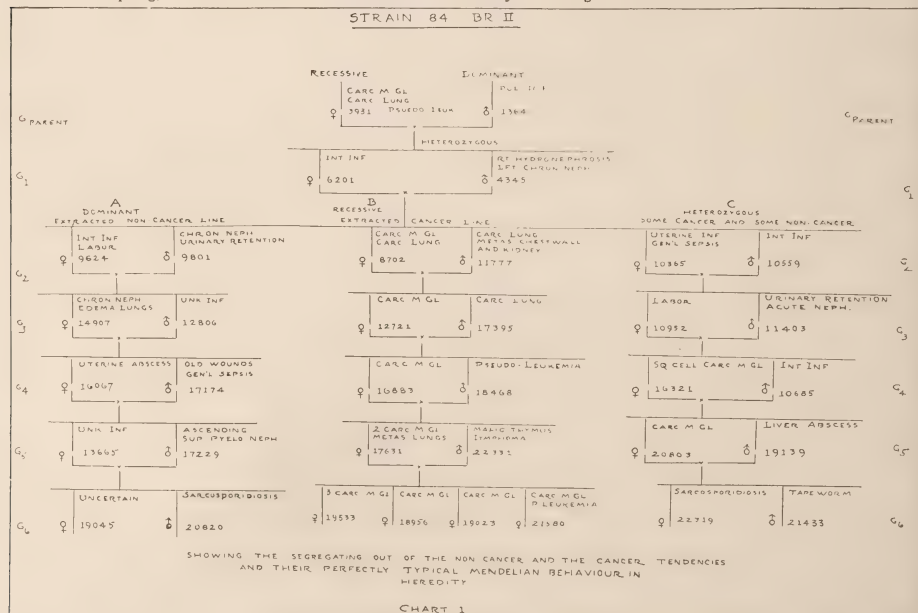
Now the unique feature of natural law is that we cannot break it. We can study it, learn to understand it and work with it, or we can continue to ignore it and combat it and be broken by it; but we cannot break it or change it—only so does the organic world hold together. It is a general law, this law of heredity, not one law for a mouse and another for a man, another for a guinea pig, and another for a geranium, but one common law of heredity—what goes into the germ plasm comes out in the offspring, whether it is the

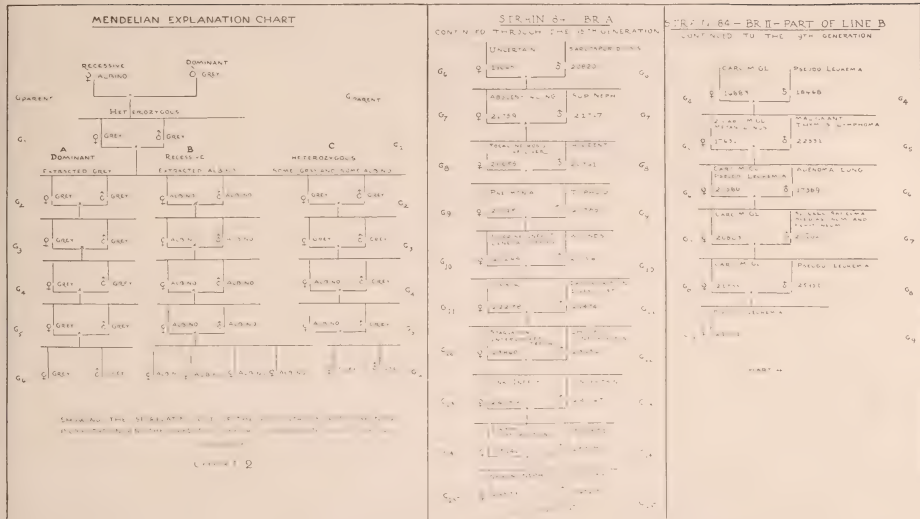
seed of a geranium, the ovum of a guinea pig or of a man. And in the progress of evolution, we see the constant and unbroken control of heredity, so that man, the latest produce of evolution, starts with a single cell, recapitulates in his embryonal growth the history of organic evolution, and in his turn sets off the single cell, the germ plasm, made of the stuff he received from his ancestry. He puts into it the identical material, which in its turn again divides and in its embryonal development briefly recapitulates organic history and in time becomes the finished example of the species. He is made of the material received from his ancestry, and of this alone—his general build, his length of leg, his shape of nose, his hair color, the kind of kidney he has, and the kind of liver he has, and the kind of lungs and heart he has, the kind of epithelium he has and the kind of connective tissue, and the kind of endothelium. He starts with vague nose shape, but it will grow into the nose shape of his ancestors. He starts with tiny legs, but they will grow to the inherited length. He inherits a liver which will in time react like the livers of his ancestors to the same causes. He inherits a type of epithelium and of connective tissue which will in time react like the epithelium and the connective tissue of his ancestors to the same causes.

So much for the general, the immutable law of heredity—what goes

into the germ plasm comes out in the offspring.

How does heredity work? As long ago as 1865 Mendel worked out with green peas the best study of the method of heredity that we have ever had. Later, and following him, Cuenot and others worked it out with mice, and it worked out with mice exactly as perfectly as it worked out with peas. Now it is vastly further in the scheme of evolution from peas to mice than it is from mice to man. Mice are mammals like man; their structure is like man's—a head, a trunk, four limbs. Their organs are like man's, arranged in the same relation to each other, made out of the same types of materials, functioning in the same way for the maintenance of the organism. If we cut a mouse's arm it bleeds like man's, and then regeneration sets in as it does in man, the edges draw together, the epithelium proliferates, scar tissue is formed, which eventually, either in part or in whole, is absorbed—a process identical with that of man's tissues, functioning like those of a man, just as the geranium does if you cut it. Why? The law of heredity, transmits a type of protoplasmic behavior down the full line of evolution; similar tissues function in the same way because they were derived from a common ancestry. If we do not accept this, we must discard the theory of evolution, for this is the heart of the theory of evolution.





I have here quoted somewhat at length from my article now in press and to appear shortly in the *Journal of Cancer Research*, because these fundamental biologic facts cannot be too often repeated. Indeed, it seems to be one of the profoundest needs of medical science today that it should adjust itself to these fundamental biologic laws and base itself upon them; and it is one of the pre-eminent aims of the work of this laboratory to assist in setting biology in its relation to pathology and to therapy.

As already stated, the work of this laboratory, carried on for twelve years, and during all that time yielding perfectly consistent results, has shown that the cancer tendency and the non-cancer tendency are some of the characters that go into the germ plasm and inevitably come out in the offspring of mice in exact accordance with the basic laws of heredity. Therefore, unless we state that there is no such thing as biologic unity or organic law, we must admit that these are characters which go into the germ plasm, and therefore come out in the offspring of man in exact accordance with the basic laws of heredity.

Now the method of heredity as worked out by Mendel, and repeated with mice by Cuenot is this: When a purebred house mouse, grey, is crossed with a purebred albino, the first hybrid generation will all be gray. That is, the tendency to pigmentation is dominant over the tendency to the lack of pigmentation. Now if we mate two of these first generation hybrid greys (heterozygotes) we shall get in the

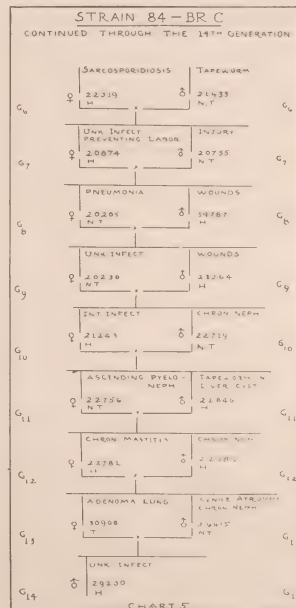
second hybrid generation some purebreeding greys (dominants), some heterozygous greys and some albinos (recessives) in the proportion of one to two to one. These dominant greys, if bred together or hybridized with other dominant greys similarly derived, will breed true. The recessive albinos whether inbred or hybridized with other purebreeding albinos, will breed true.

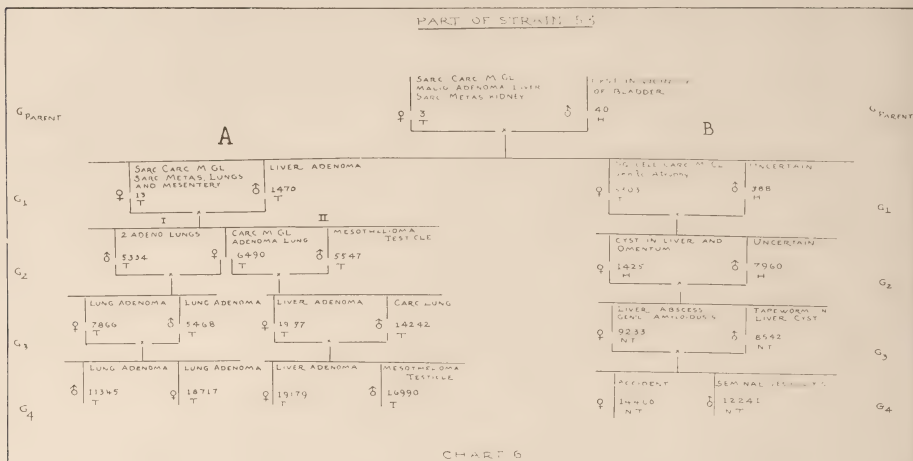
The heterozygous greys, whether inbred or hybridized with other heterozygous greys similarly derived, will again yield the three types, dominant greys, heterozygous greys, and recessive albinos, in the proportion of one to two to one. (See Chart 2.)

Again, if we cross a purebred albino with a heterozygous grey, we shall get, in the first hybrid generation, recessive albinos and heterozygous greys in the proportion of one to one. These albinos will breed true whether inbred or hybridized with other purebred albinos. The heterozygous greys, in this case also whether inbred or hybridized with other similarly derived heterozygous greys, will give the same three types, dominant greys, heterozygous greys, and recessive albinos.

Again, if we cross a dominant grey with a heterozygous grey, the first hybrid generation will give dominant greys and heterozygous greys in the proportion of one to one. The dominant greys will breed true, and the heterozygous greys will again give the same three types.

Why do these characters behave in this way? That they do is certain. What is the secret of the method of heredity? If we mate two purebred albinos the offspring will all be albino; that is, there will be a complete lack of the pigment-making mechanism. Pigment is an absent character in these individuals. It did not go into their germ plasm and they cannot transmit it to their offspring. If only albino mice are allowed to breed, the pigment-making mechanism will be lost for mice and cannot be recovered, and there will





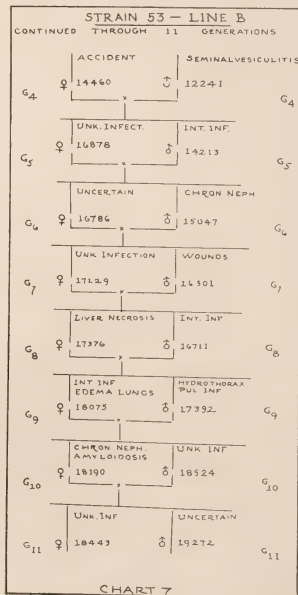
thereafter be only albino mice. Albinism is a recessive character. Purebred albinos cannot transmit the dominant.

Now, if we mate the same purebred albino, into whose germ plasm no pigment-making mechanism went, with a grey house mouse into whose germ plasm the tendency to pigment-making mechanism did go, we shall get in the first hybrid generation, heterozygous greys, that is, pigment-making is dominant over the lack of pigment-making, therefore the mice are grey. But into their germ plasm went from one side the absence of the pigment-making mechanism (as a unit character), and from the other side went the presence of the pigment-making mechanism (another unit character); so, since both these unit characters went into their germ plasm, both of these characters will come out somewhere in the offspring—the law of heredity.

All efficient study of heredity is the study of the behavior of unit characters. Only we must be sure that we have analyzed our characteristics into unit characters, which segregate out and are transmitted as such, like albinism and pigmentation, spotting and self-color, etc. And conversely when in the study of heredity we have found a character which does segregate out and is transmitted as such, we have found a unit character, which will behave in accordance with the immutable law of heredity for the unit character. A unit character is then to heredity what an electron is to chemistry—in capable of analysis, it segregates out and is transmitted as such.

Now, when we are dealing with a complex organism, like a man or a mouse, there is a multiplicity of these

unit characters which have gone into his germ plasm from his ancestors, and which will get into all possible combinations, for example, a tendency to a heavy and a tall skeleton; a tendency to a particular length in the limb; a tendency to blackness of hair with a tendency to curliness of hair; a tendency to a straight nose with a tendency to a large nose; a tendency to a certain kind of liver, which will tend to a certain type of epithelium, with a tendency to a certain type of behavior, etc.—all unit characters.



Every organism then is a synthesis of unit characters, which cannot be correctly manipulated or interpreted in experimental work with accurate results, until it has been analyzed into its component unit characters. Until the truth of this fact has come home to the experimental biologist, pathologist, bacteriologist and student of therapy, our results are certain to be invalidated by artifacts. This applies in all experimentally produced cancer, whether by grafts or by artificial chronic irritations like painting with coal tar products, and feeding with nematode and tapeworm larvae, just as it applies everywhere else in experimental research. First by analyzing our stocks into unit characters, we must learn what portion of the result is produced by nature without reference to the experiment, and what is the experimental residuum.

With these things in mind, I undertook the study of the heredity behavior of cancer, to find out the nature of cancer; partly in order to learn how to get rid of a hideous disease, and partly for the light such a study must throw on general biologic problems of all tissue behavior. I proceeded to study the inheritability of neoplasms in exactly this classic way, that is, by making a biologic analysis of stock, without which no stock is of any value for conclusions concerning heredity, or practically anything else.

In order to make a biologic analysis of stock, it is necessary to breed it out, so as to find out what unit characters went into its germ plasm. It then becomes a stock made up of analyzed individuals, whose hereditary potentialities are known and whose effect in any cross can be predicted. On the other

hand, if you buy animals in the market and proceed to use them for even a simple experiment, they are worthless until they are analyzed. Because some of them may be purebred and some of them inevitably will be heterozygous in many respects, and they will not behave alike in any given experiment, since they have not the same unit characters. You have no biologic control in the experiment until each animal to be used has been analyzed.

In the study of the inheritability of cancer, then, having first made a thorough biologic analysis of stock by hybridization and by inbreeding, I found that equally by the method of hybridization and by inbreeding, if you mate two mice having carcinoma of the lung (primary or secondary) you can extract from them a strain of 100 per cent lung tumor mice. Again, by mating two mice having mammary gland carcinoma, a strain of 100 per cent mammary gland carcinoma mice can be extracted from them, etc. That is, both in inbreeding and in hybridization, the cancer tendency and the non-cancer tendency behave like unit characters, that is, they segregate out and are transmitted as such.

I tried also further tests of hybridization between cancer mice and absolutely non-cancer mice. By a cancer mouse we mean a mouse whose ancestry had cancer, into whose germ plasm the cancer tendency entered, and who

himself has cancer. By a non-cancer mouse we mean a mouse which came from wholly non-cancer ancestry, into whose germ plasm there went the tendency to the absence of cancer, and who therefore cannot transmit it to his offspring. They are analyzed individually, both of them, whose heredity behavior in the matter of cancer can be predicted.

If I mate such a non-cancer mouse with a cancer mouse, into the common progeny of these two there goes (1) a tendency to cancer, and (2) a tendency to the absence of cancer; and the first hybrid generation can, and infallibly does, transmit some of both these tendencies. *But cancer is recessive to non-cancer, and so the first hybrid generation shows none of it, and throughout my entire experience never has shown in it a single case; but the tendency to cancer segregates out, and in the second hybrid generation it appears again, in the same organs and in the same tissues of those which show the ancestral tumors.*

CHART I

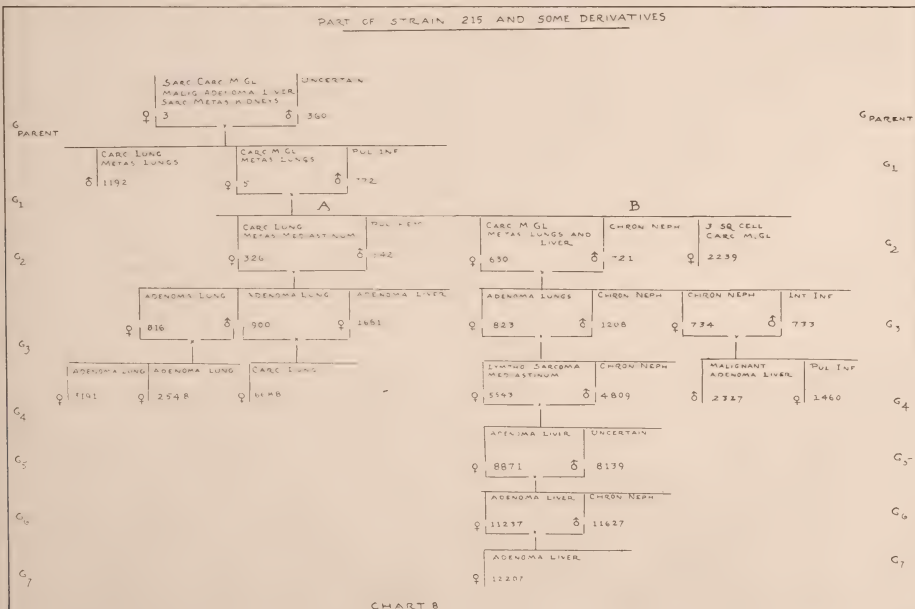
Note Chart 1, showing three lines derived from Strain 84, Branch II. This chart is perfectly typical. The parent female, 3931, died of carcinoma of the mammary gland, carcinoma of the lung and pseudoleukemia. She was hybridized with absolutely non-cancer male 1364, who died of pulmonary infection. In accordance with the

Mendelian expectation from such a cross, no cancer appears in the first hybrid generation. Cancer is recessive to non-cancer. For the parents of this branch of the family, female 6201 and male 4345, both heterozygotes, were selected.

Note how there were extracted from this hybrid cross three lines of mice: (A) the dominant, which neither in direct descent nor in any accessory fraternities, ever showed one case of neoplasm, malignant or benign; (B) the recessive line, 100 per cent malignant disease, and (C) the heterozygous line showing both cancerous and non-cancerous individuals. Note how the same types and locations of neoplasms which were bred into the strain with parent female 3931, segregate out and are transmitted as such wherever tumor occurs, both in the recessive, 100 per cent cancer line B, and in the heterozygous line C, namely, carcinoma of the mammary gland, carcinoma of the lung, pseudoleukemia, and its closely related tumor type, thymus lymphoma.

It is interesting to note that in the animals of this stock, chronic leukemia and pseudoleukemia (alymphatic leukemia, not lymphogranulomatosis) have occurred only in the cancer strains and have behaved as if they were true neoplastic diseases. As yet we have not analyzed this material and are not prepared to discuss the matter further than the mere statement of the fact, which

PART OF STRAIN 215 AND SOME DERIVATIVES



is in support of the contention of many pathologists, that chronic leukemia and pseudoleukemia are as much true neoplasms as are lymphosarcomas.

Chart 1, then, shows the segregating out and the transmission as such of the non-cancer and the cancer tendencies, also the tendency to a specificity of tissue type, which locates the neoplasm in a certain organ, and their perfectly typical Mendelian behavior in heredity as unit characters.

CHART 2

Note how exactly this follows the Mendelian expectation, as shown in Chart 2, giving the classic behavior where a hybrid cross is made between the recessive albinism and the dominant pigmentation. Here also three lines are extracted, individual for individual, parallel with those shown in Chart 1, namely (1) a dominant line A, in which albinos never occurred either in the direct descent or in the accessory fraternities; (2) a recessive line B, 100 per cent albinos, in which no pigmented individual ever appeared, and (3) a heterozygous line C, showing some albinos and some pigmented mice.

Chart 2, then, shows the segregating out and the transmission as such of the pigment-making tendency and the lack of the pigment-making tendency, and their perfectly typical Mendelian behavior in heredity as unit characters. That is, the pigment-making tendency and the non pigment-making tendency behave in the matter of heredity just as did the cancer and the non-cancer tendencies shown in Chart 1.

CHART 3

Chart 3 continues part of Line A extracted from Strain 84, Branch II, through the fifteenth generation without the occurrence of a neoplasm of any sort. This shows the absolute segregating out and the transmission as such of the non-cancer tendency. When a non-cancer line has once been extracted spontaneous neoplasms have never, throughout my entire experience, occurred in such a strain again, unless cancer has again been hybridized in from an outside source. Never in Line A nor in any accessory fraternities has a neoplasm of any sort whatever occurred.

CHART 4

Chart 4 continues Strain 84, Branch II, Line B through the ninth generation. This is the 100 per cent line extracted from this same cross which yielded the 100 per cent non-cancer strain shown in Chart No. 3. Note how the types and locations of the neoplasms occurring in this line of the strain are the same as those bred into it in the original cross, from female 3931, namely, carcinoma of the mammary gland, carcinoma of the lungs, and pseudoleukemia with its closely related tumor type, thymus lymphoma. Note female 21580 in generation six with the carcinoma of the mammary gland of her grandmother and the pseudoleukemia of her grandfather. Note also the interesting sequence here of pseudoleukemia and thymus tumors through six consecutive generations, following the selection of male 18468 as the parent male in generation four. Note

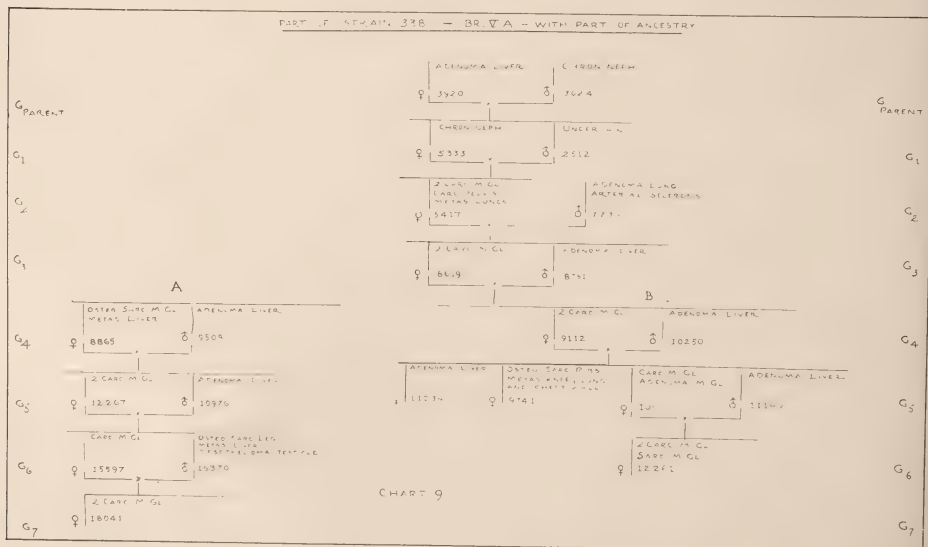
also that the original parent female 3931 (shown in Chart 1) had pseudoleukemia along with carcinoma of the mammary gland and primary carcinoma of the lung. Note male 20102 in generation six, with a spindle cell sarcoma of the entire mediastinum and of the peritoneum. This single case of sarcoma was derived from an ancestor several generations antecedent to female 3931, the parent of Strain 84. Lack of space prevents the showing of this ancestral sequence in the single chart.

CHART 5

Chart 5 continues Line C of this same strain through the fourteenth generation. This is the heterozygous line. Note how, by the continued selection of a heterozygous individual for mating with a non-cancerous mate (as indicated by "H" and "N.T." in the chart) all occurrence of neoplasms was held off until the thirteenth generation. Here, by the mating of two mice heterozygous to lung tumor, lung tumor occurred in the thirteenth generation, the parents concerned being female 22781 and male 22986. Lung tumor is one of the tumor types carried by this line. By the right selective breeding in any heterozygous line, neoplasms can be made to occur or can be held off at will.

CHART 6

Chart 6 shows part of Strain 53, Line A branching into two extracted 100 per cent tumor families, and Line B, from the same parents, developing into a 100 per cent non-cancerous family. The heterozygous line is not



shown in this chart, owing to lack of space. Note how, in Line A, Family I, a 100 per cent lung adenoma family is being extracted by the selection, as parents of the family, of two mice with lung adenoma, namely male 5334 and female 6490; while in Family II of the same Line A, liver adenomas and mesotheliomas of the testicle are the prevailing tumor types; there being four liver adenomas in the ten individuals forming the direct descent of these five generations.

Note that in Line B after the first hybrid generation (female 5303 with a squamous cell carcinoma of the mammary gland) there was no further appearance of tumor. By the continued selection of non-tumorous individuals after the second filial generation, all neoplasms were completely ruled out of this branch of the strain.

Note female 13 of filial generation 1, Line A, with a sarcoma-carcinoma of the mammary gland like her mother, female 3, and with secondary sarcomas in the lungs and mesentery. Note how with her secondary lung tumor she was able to start a 100 per cent lung tumor line, the secondary lung tumor being as efficient as a primary lung tumor in transmitting lung tumor potentiality. This point is discussed at length in a previous report. (10)

Note the prevalence of cyst and abscess formation in Line B of Strain 53, although in no case do these cysts or abscesses lead to tumor formation in this family. The offspring is made of the identical material of the germ plasma of its ancestry, and its tissues behave in the same way.

CHART 7

Chart 7 shows Line B of this strain continued through the eleventh genera-

tion without the occurrence of neoplasms. Never, either in the direct descent or in any accessory fraternity did a neoplasm of any kind occur in this branch of Strain 53 after the neoplastic tendency had once been bred out from the second filial generation.

CHART 8

Chart 8 shows part of Strain 315 and some derivatives. Note the 100 per cent lung tumor strain being extracted in Line A from female 5 with secondary carcinoma of the lung. Note the 50 per cent liver adenoma strain being extracted in Line B. Strain 215 was made by the mating of female 3, who had a sarcoma-carcinoma of the mammary gland, a malignant adenoma of the liver and sarcoma metastasis in the kidney, with male 360, who was proved heterozygous to lung and mediastinal tumors. Note how the different types and locations of neoplasms introduced by these two parents segregate out and are transmitted as such in the succeeding strain.

CHARTS 9 AND 10

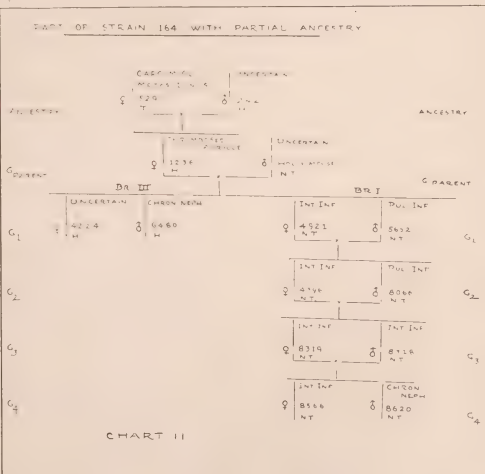
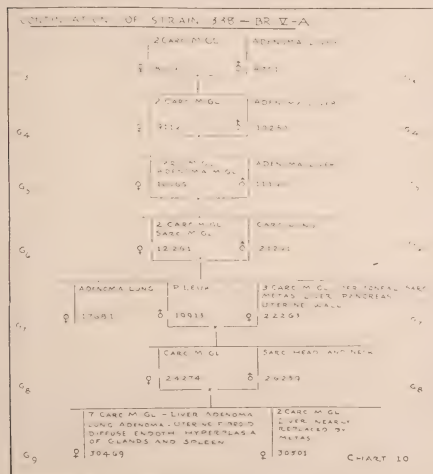
Charts 9 and 10 show part of Strain 338, Branch V, with partial ancestry, and its offspring carried through the ninth generation. The original ancestor of this strain also was female 3, already referred to in Chart 8. She had a sarcoma-carcinoma of the mammary gland, a malignant adenoma of the liver and sarcoma metastasis in the kidney. Note the striking outcropping of liver tumors in this strain. Note how the different unit characters, sarcoma, carcinoma, and specificity of liver tissue type, get into all possible combinations in the strain, so that even in the small number of individuals represented in these two charts, we find carcinoma of the liver, sarcoma of the liver, both

primary and secondary, and adenoma of the liver.

That is, the carcinoma tendency segregates out and is transmitted as such. The sarcoma tendency segregates out and is transmitted as such. The adenoma tendency segregates out and is transmitted as such. A specificity of liver tissue which will insure its yielding to neoplasms, segregates out and is transmitted as such. These are all unit characters, and they get into all possible combinations even in this one small family alone.

I have from necessity selected only a few strains for the charts in this report. They are perfectly typical, however, and are representative of the hundreds of other strains, tumorous and non-tumorous, inbred and hybridized, which have been produced by selective breeding alone, and which have been analyzed in this laboratory for the past fifteen years. I have, therefore, been able to express the matter in little more than outline, and there are many and diverse ramifications of the work, which, for the sake of unity, I cannot enter into at all this time. But certain facts have consistently obtained in this work for twelve years, and these I wish to emphasize with their application.

Cancer and non-cancer have behaved consistently just as true albinism and pigmentation do in heredity. That is, just as true albinism is the total absence of the pigment-making mechanism present in the pigmented mouse, so spontaneous cancer consistently behaves as though there were absent a mechanism fitted to control proliferation and differentiation in regenerative processes. At any rate, whether or not it is exactly this, it seems to be the absence of



some controlling mechanism, and an animal either has it or does not have it, whether he is a mouse or a man.

Whenever spontaneous cancer comes out in a strain, it is because it has been bred in, in some degree; and however remote the cancer ancestry we shall find it, if we analyze far enough. *Moreover, we shall find not only the neoplastic ancestor, but the ancestors that carried the same types and the same locations of neoplasms shown in the later generations.*

There is no appearance of spontaneous tumor in any non-tumor strain. There are all percentages of cancer, some even as low as .01 of 1 per cent, in varying cancer strains. That is, cancer and non-cancer behave respectively as though there were absent or present a particular controlling mechanism, and an individual, whether it is a mouse or a man, either has it or lacks it.

The unit characters concerned in the heredity of spontaneous tumors, whether we are dealing with mice, with rats, or with man, are these: (1) A specificity of tissue type from organ to organ, which determines that the liver or the kidney, or the uterus, or the mammary gland tissue, etc., shall be like the tissue of its ancestral organ (from which it was derived) and shall react in the same way to the same cause. For example, liver tumor begets liver tumor, etc. (2) A specificity of epithelium from ancestor to offspring, which will cause it to proliferate without differentiation, and without control, under a given provocation; that is, carcinoma begets carcinoma. (3) A specificity of connective tissue from ancestor to offspring, which will cause it to proliferate without differentiation and without control, under a given provoca-

tion; that is, sarcoma begets sarcoma.

Like all other unit characters, the unit characters here enumerated may get into all possible combinations; and we therefore when dealing with fundamentally and completely analyzed stocks, have such a result as shown from female 3. This female 3, with a sarcoma-carcinoma of the mammary gland, a malignant adenoma of the liver, and sarcoma metastasis in the kidney, is able to transmit to her posterity (and has so transmitted) all possible combinations of these unit characters, namely, carcinoma of the mammary gland, sarcoma of the mammary gland, sarcoma-carcinoma of the mammary gland, adenoma of the mammary gland; carcinoma of the liver, sarcoma of the liver, adenoma of the liver; sarcoma of the kidney, carcinoma of the kidney, adenoma of the kidney.

There are only two possible methods of studying the inheritability of any character whatever, cancer or anything else. These are (1) the long, painstaking, difficult analysis of stock in the laboratory, so that we obtain analyzed individuals whose hereditary potentialities are known quantities and can be manipulated as such. This is the method which has been pursued in this laboratory for fifteen years, and (2) the so-called statistical method which has been in vogue in the study of the inheritability of cancer in man.

All human statistics of this nature are based upon two things, both of which may be in error. Namely, the memory of the patient, and the diagnoses concerning his ancestry. Rarely, back of one generation, are the facts accurately remembered or the diagnoses based upon autopsy. We have, then, no certain scientific material whatever

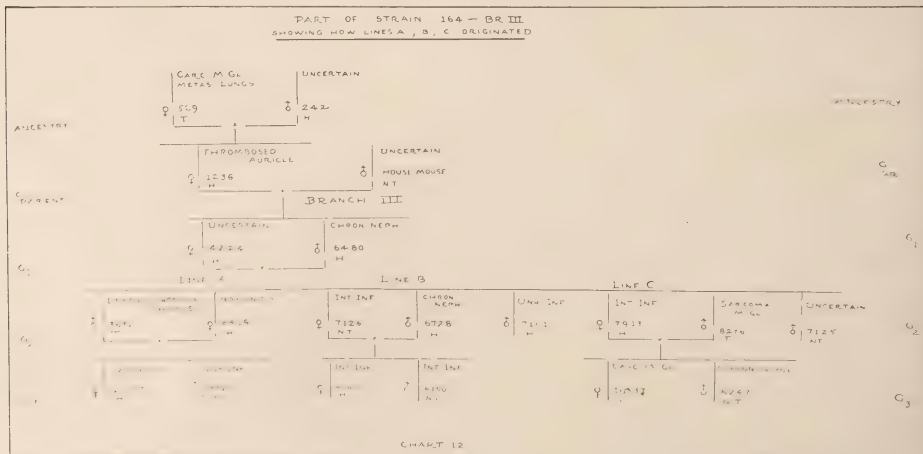
to deal with in these statistics. But where these statistics are right, as they frequently even by chance must be, *a biologic reading of them would show that they also demonstrate the inheritability of cancer in man.*

CHART 11

Note Chart 11, showing part of Strain 164 with partial ancestry on the maternal side. Female 1236, who died of a thrombosed auricle (a condition somewhat frequent in this laboratory) was the parent female of this strain. Her mother was tumorous (indicated by "T" in the chart) and died of a mammary gland with metastases in the lungs. Her father, male 242, died of uncertain causes. He did not himself have tumor, but was proved heterozygous to tumor (indicated by "H" in the chart) that is, he inherited it from cancerous ancestry and transmitted it to his offspring, although not himself having tumor.

The male parent of Strain 164 was a purebred house mouse, and died of uncertain causes. He was a member of Strain 358, in my hands many years without the occurrence of tumor of any sort, malignant or benign, in any of its fraternities. He himself was analyzed, proved non-tumorous mouse (indicated by "N.T." in the chart).

In the first hybrid generation from this cross (namely between a heterozygote and a non-tumorous mouse) no tumor of any sort has ever occurred. Cancer is recessive to non-cancer. In this chart the only members of the first hybrid generation of Strain 164 that are shown, are two pairs, namely female 4224 and male 6480, the parents of Branch III of the strain; and female 4921 and male 5652, parents of Branch I of the strain. Female 4224



and male 6480 of Branch III were both proved heterozygous to cancer, while female 4921 and male 5652, parents of Branch I were both proved non-tumorous mice.

Note that the progeny in Branch I were all absolutely non-tumorous. Nowhere, either in the direct descent nor in any of the accessory fraternities in this branch of the strain, has there ever been a single occurrence of tumor of any sort, malignant or benign. This is the classic Mendelian behavior to be expected from the mating of two individuals carrying the dominant, that is, the non-cancer tendency, like female 4921 and male 5652. Branch I, then, of Strain 164, is an absolutely non-tumorous family, every member of which has been analyzed and has proved to be non-tumorous, both in inbreeding and in hybridization; although this branch was derived from cancer ancestry on the maternal side. This shows conclusively that the non-cancer tendency also segregates out and is transmitted as such, and that by the right selective mating the cancer tendency can be ruled out absolutely from a family, beginning with the second hybrid generation.

CHART 12

Chart 12 shows the origin of Branch III of this same Strain 164, and the parentage originating the three lines A, B and C, in which this branch has been bred out. The succeeding charts will show the continuation of these three lines.

The parents of line A were tumorous male 3672, who died of a lymphosarcoma of the thymus, and heterozy-

gous female 8419, who died of peritonitis. Their two offspring selected to carry on this line, were both heterozygous to tumor, namely female 10597, who died of tapeworm, and male 8521, who died of intestinal infection.

The parents of Line B were non-tumorous female 7126 and heterozygous male 6728. Their offspring selected to carry on Line B were heterozygous female 8146 and non-tumorous male 8150, both dying of intestinal infection.

The parents of Line C were heterozygous female 7913 and tumorous male 8276, who died of sarcoma of the mammary gland. Their offspring selected to carry on Line C were tumorous female 10537 with a carcinoma of the mammary gland, and non-tumorous male 8247, who died of chronic nephritis. This chart, then, shows how lines A, B and C of Branch III. Strain 164 originated.

CHART 13

Chart 13 shows Line A of Branch III, Strain 164, continued through eight generations. Note how, by the right selective matings of heterozygous and non-tumorous mice, the occurrence of malignant disease is held off until the sixth generation. If, now, female 12876 with a lymphosarcoma of the mesentery, left kidney and right ovary, had had her statistics taken in the hospital without error, even for three generations, no statistics of tumor would have appeared; nevertheless the inheritance of her tumor type is direct from her grandfather four generations back. By the mating of two heterozygous individuals from this tumorous mother,

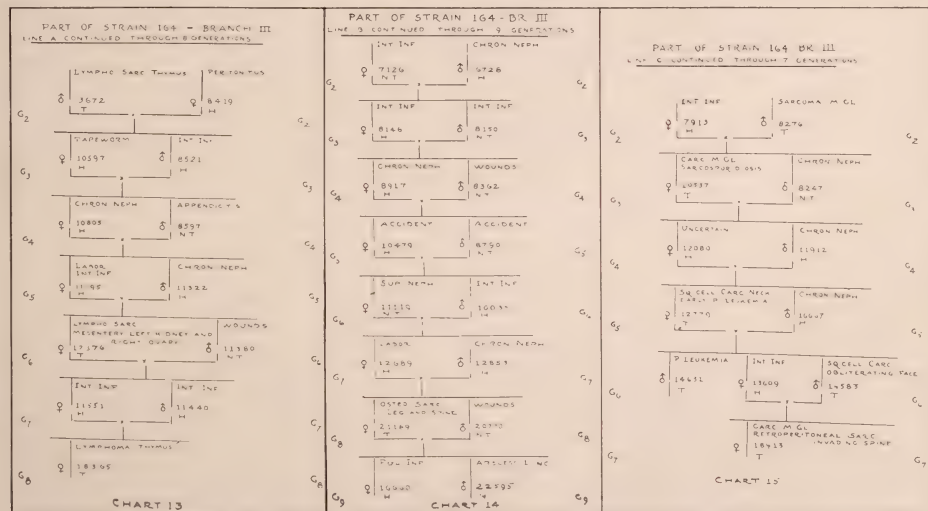
namely female 11551 and male 11440, again in the next generation a malignant thymus lymphoma occurs in female 18365. At the same time, all other types and locations of tumors are ruled out from this strain, by the right selective matings.

CHART 14

Chart 14 shows Line B of Branch III, Strain 164, continued through nine generations. Note how by continued matings of heterozygous and non-tumorous individuals, all occurrence of malignant disease has been held off until the eighth generation. If female 21189 of the eighth generation, who died of an osteosarcoma of the leg and spine, had had her hospital statistics taken even seven generations without error, there would have been no appearance of tumor. Nevertheless, by tracing far enough back, we find the ancestor with malignant disease. This chart shows with what certainty the tendency to neoplasms can be manipulated and controlled. Through generation after generation it was carried along by heterozygous individuals, certain to appear when the right matings were made.

CHART 15

Chart 15 shows Line C of this branch of Strain 164 continued through seven generations. Here, by mating tumorous female 10537 with proved non-tumorous male 8247, no tumor occurred in the next generation. But by the selection of two heterozygotes of generation 4, carcinoma appeared in the succeeding generation (generation 5) in female 12779 with a squamous cell carcinoma of the neck and pseudo-



leukemia. Again, by the mating of this female with heterozygous male 16667, note how both pseudoleukemia occurred in the next generation, male 14631, and also squamous cell carcinoma of the neck, which at death had extended anteriorly and obliterated the face, male 14583. Female 18413, daughter of male 14583, showed the carcinoma of the mammary gland of her grandmother four generations back and the sarcoma of her grandfather five generations back. When a given type or location of neoplasm is bred in, it can be manipulated with absolute accuracy by the type of selective breeding used. It can be made to hold off for any number of generations desired, or to appear in the next generation, as in the case of male 14583 with a squamous cell carcinoma of the neck in generation 6, following female 12779 with a squamous cell carcinoma of the neck in generation 5; or male 14631 with pseudoleukemia in generation 6 following female 12779 with pseudoleukemia in generation 5.

If human cancer statistics when correctly taken, were biologically read, they would show as certainly as do mouse statistics the inheritability of cancer. They would show that the human heterozygote carries and transmits neoplastic tendencies, exactly as do mouse heterozygotes, although they themselves do not develop the disease. This follows exactly the classic Mendelian pattern from the mating of pigment-bearing with non pigment-bearing mice.

CHART 16

Chart 16 shows part of Strain 392. The parent, female 26, had a sarcoma of the ovary, sarcoma of the liver, sarcoma of the kidney and perirenal tissues, and a sarcoma of the mesentery. She was mated with male 814, who died of myocarditis. By the right selective mating, the occurrence of sarcoma (and all types of neoplasms) was held off through the three succeeding generations. In the third hybrid generation by the selection of two individuals heterozygous to sarcoma, sarcoma appeared in the immediate offspring (generation 4) female 12058, who repeated the sarcoma of the kidney and of the ovaries of her grandmother four generations back and added also bilateral sarcoma of the uterus. No human hospital statistics could have shown the correct cause of death through four generations. If therefore, this had been a human case, there would have been no record of tumorous ancestry—yet there is here the most evident and perfect persistence and final emergence of the exact type and loca-

tions of neoplasms, through the right selective breeding to bring it out.

CHART 17

Again note Chart 17, showing Strain 465 with partial ancestry. Let me go through this chart somewhat in detail, in order that we may see the perfect evidence, it affords of (1) the segregating out of tumor types and their consequent inheritability, and (2) the segregating out and consequent inheritability of a specificity of organ tissue type, transmitted through generation after generation both where inbreeding and where hybridization was employed.

Female 3 and male 30 were the ancestors of the paternal side of this strain. Female 3 had a sarcoma-carcinoma of the mammary gland, a malignant adenoma of the liver, and sarcoma metastasis of the kidney. Male 30 was proved heterozygous to tumor. This is a case then of mating a tumorous individual (recessive) with a heterozygote. In accordance with the Mendelian expectation from such a cross, tumor comes out in the first hybrid generation, namely female 883 with an adenoma of the liver.

In the first filial generation, this female 883 with an adenoma of the liver, was hybridized with male 842, who died of uncertain causes, but who was proved heterozygous to tumor. Their son, male 1101 dying from acute nephritis, was heterozygous to liver tumor. He was hybridized with female 441 (entirely unrelated) who was also heterozygous to tumor. Their son, male 3024, was hybridized with female 3920, who came of a liver tumor ancestry and who herself had an adenoma of the liver. The outcropping of liver tumor in the second hybrid generation, female 5305 with a sarcoma of the liver. Note here how there segregated out on the one hand the unit character sarcoma introduced by fe-

male 3, five generations back, and on the other hand the specificity of liver tissue type locating tumors in the liver, which also was originally introduced by female 3, transmitted through and reinforced by female 883 and female 3920. Note how in this generation the unit character sarcoma got into combination with liver tissue of a type to yield to neoplastic growth (another unit character), so that we have in female 5305 a sarcoma of the liver.

This female 5305 was hybridized with male 5215, who died of chronic nephritis. Through three succeeding generations, by the right selective matings, all occurrence of neoplasm was held off. But the certainty of its transmission by heredity is indisputably demonstrated, for, by the use of analyzed individuals, two mice heterozygous to liver tumor were selected in the third filial generation, namely female 9847, who died of chronic nephritis, and male 8852, who died of a lung abscess, so that liver tumor appeared in the next generation. Not only liver tumor occurred, but the same combination of unit characters occurred, namely, the combination of sarcoma, and the neoplastic tendency in the liver.

Let me summarize the facts demonstrated in this chart (Chart 17).

(1) Sarcoma segregated out and was transmitted as such.

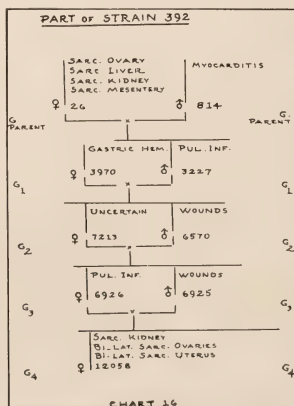
(2) Adenoma segregated out and was transmitted as such.

(3) Other types of neoplasms segregated out and were not transmitted at all in this line of succession.

(4) A specific type of liver tissue (viz. lacking the non-cancer mechanism) segregated out and was transmitted as such, so that five liver tumors occurred in this small family alone.

(5) A specific type of tissue in all other organs (viz. possessing the non-cancer mechanism) segregated out and was transmitted as such, so that all other organs refused neoplastic growth, with the single exception of female 11252, whose liver sarcoma spread by extension into the common bile duct, and who had also a lymphosarcoma of the stomach; but it is notable that this is the family in which nearly all of the few stomach tumors in this stock have occurred.

In the light of such perfect evidence as this, it is logically absurd to question the segregating out as unit characters of the sarcoma tendency, the carcinoma tendency, the adenoma tendency, and the tendency to a specific type of organ tissue determining the location of neoplasms, and their transmission as such by heredity. Moreover, when we have such analyzed human individuals and such exact data concerning their neo-



plasms (if such a time ever comes) we shall find that exactly the same laws govern the transmission and occurrence of human neoplasms, otherwise there is no such thing as biologic or organic law.

Charts 11 to 17, inclusive, show how the tendency to neoplasms of specific types and of specific organs is carried along by heterozygotes, and how by the right selective matings alone, both in inbreeding and in hybridization neoplasms of these types and of these organs can be held off or brought out at will in the resulting strains by the use of analyzed individuals. Such neoplastic tendencies can be carried along by heterozygous individuals through any number of generations desired, just as the tendency to albinism can be carried along by heterozygotes as long as may be desired. But by the right selective breeding, both the neoplastic tendency and the albinic tendency can be made to emerge at will.

The heterozygote, then, the product of hybridization in any species or any variety, in whom the recessive (cancer or albinism) lies hidden but potent for transmission, may be a very puzzling factor in heredity; for he contains in his germ plasm and therefore can transmit to his offspring, unit characters different and frequently opposite in nature. As, for example, a pair of heterozygous black mice transmitting albinism to their immediate offspring, or a pair of heterozygous non-cancer mice transmitting cancer to their immediate offspring, because potential cancer went into the germ plasm from which the heterozygotes developed. The heterozygotes in the human cancer problem have been the individuals who have blinded the readers of human statistics to the fact of the inheritability of human cancer, hiding as they do the recessive (cancer) behind the dominant appearance, which is appearance only.

There is a very widespread objection in the medical profession today to the thought that cancer is inheritable, and a very widespread and ready categorical denial of its inheritability, on the basis of these erroneous and misread cancer statistics. As the opinion of many physicians and surgeons in this matter is based upon the statements made by the Society for the Control of Cancer, let me here quote from this year's annual leaflet put out by the society, item No. 6: "Cancer is not inherited. It is not certain even that a tendency to the disease is inherited."

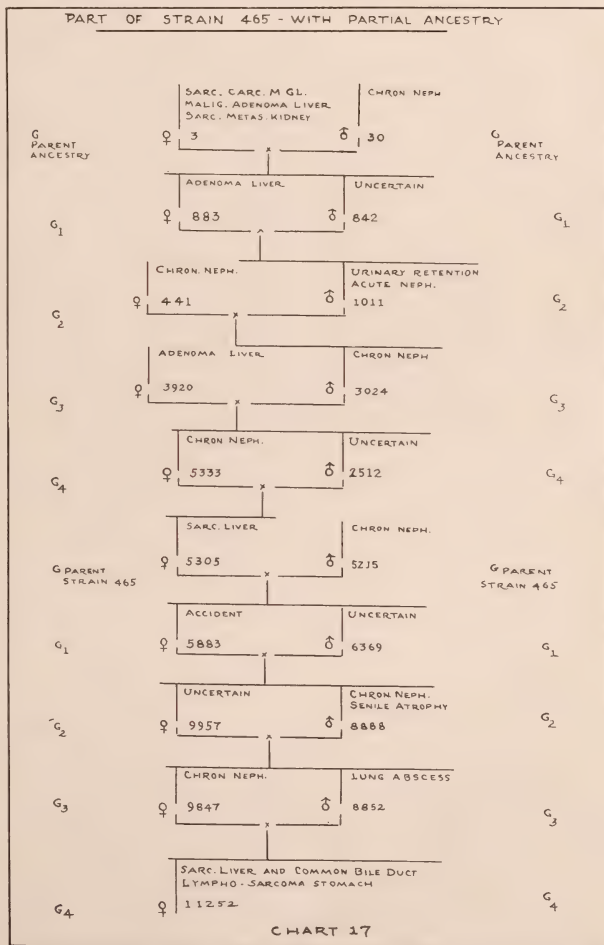
Let us subject this excerpt to the biologic test. I have reminded you that man repeats in his embryonal development the history of organic evolution. He begins as a single cell. In this cell there is no nose, no legs, no

vertebrae arranged in a perfect and beautiful spinal column, no liver, no epithelium, no cancer. What resides in this single cell is tendency to all these things. That is the basis of all heredity. All inherited characters are inherited tendencies of the cell. There is no other form of inheritance.

I have emphasized the evolutionary basis of the law of heredity, a common law of protoplasmic behavior—what goes into the germ plasm comes out in the offspring; the fundamental necessity of similar tissues behaving in similar fashion if there is to be such a thing as species or race. The mouse tumors under study in this laboratory are spontaneous tumors, arising in the natural life of the animal without artificial interference of any sort except that of selective breeding, exactly as man's

tumors arise. They arise in the same tissues and in the same organs as the tumors of man; they follow the same clinical course; they cause death in the same ways. Under the microscope they present the same appearance as similar tumors in similar organs in man. *They are the same biologic entity as similar tumors in similar organs in man. And consequently, if we do not discard the theory of evolution, we must admit that they behave in the same way in the matter of heredity as in all other matters.*

When we have found, as we have found in this laboratory for twelve years, that carcinoma and non-carcinoma tendencies segregate out and are transmitted as such; that sarcoma and non-sarcoma tendencies segregate out and are transmitted as such; that a



specificity of tissue type in specific organs segregates out and is transmitted as such so that an organ either has or lacks the non-cancer mechanism; when I say, we have found that these unit characters segregate out and are transmitted as such in mice, so that we can analyze individuals and manipulate these unit characters in heredity as you can pour HCL on Zn with a known outcome—unless we discard the entire biologic science of today, we must admit that these same unit characters segregate out and are transmitted as such in man.

Moreover, the human statistical evidence admitted by the most vigorous opponent of cancer heredity, itself demonstrates the inheritability of cancer in man, when it is correctly and biologically read.

SUMMARY

(1) Cancer and non-cancer tendencies segregate out and are transmitted as such.

(2) They are, therefore, unit characters.

(2) A specificity of tissue type in specific organs from ancestor to offspring segregates out and is transmitted as such.

(4) It is therefore a unit character.

(5) Since these things are unit characters, it is possible to manipulate them by selective breeding and thereby to implant them indelibly in any species, or to eliminate them permanently and completely from any species.

(6) Cancer and non-cancer behave as though there were respectively absent or present a mechanism fitted to control proliferation and differentiation in regenerative processes, and an animal either has this mechanism or lacks it, no matter to what species he may belong.

(7) There is, therefore, a ready and certain genetic method of escape from cancer for the individual and for the race.

(8) The demonstration of the inheritability of cancer and non-cancer tendencies in mice is a demonstration of the inheritability of these tendencies in man and in all other species which show cancer, if we are to maintain the theory of evolution and to admit that there is such a thing as biologic law.

(9) The study of cancer behavior, which has demonstrated itself to be fundamentally a biologic problem, makes evident the necessity of understanding and considering the biologic facts underlying all pathologic conditions.

(10) And, therefore, when we shall have gotten biology under all our pathology and bacteriology, all our physiology and therapy, there will no longer be these monstrous diseases, but only the slow and natural death which is the fatigue and diminution and final cessation of the organ and the organism.

(11) From the procedure of analyzing stock into its unit characters in order to manipulate the cancer tendency, there has emerged the fundamental law of heredity—what goes into the germ plasm must come out in the offspring.

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Oxycephaly---Steeple or Tower Head; Turmschaedel; Spitzkopf; Turricephaly; Acrocephaly; Hypsicephaly*

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VON GRAEFE, in 1866, Michel, in 1873, and von Hirschberg, in 1883, were the first definitely to recognize and describe the association of deformity of the head with impairment of vision. Since that time many references to this interesting condition have appeared in the literature. Authors have divided the disease into two types; in one type there is no prominence or protrusion of the anterior fontanel and the condition is named turmschaedel; in the other type there are prominences and protrusions at the anterior fontanel; this condition is named oxycephaly. Oxycephaly has three cardinal features: (1) gradually progressing impairment of vision, (2) exophthalmos, and (3) characteristic cranial deformity. The cause is given as a premature synostosis, usually in the sagittal suture, next in the coronary, temporosphenoidal or parietosphenoidal, and less often in the lambdoidal and parieto-occipital sutures.

Many hypotheses have been advanced as to the cause of the synostosis. Bertolotti suggested that rachitic craniotabes and oxycephaly belong to the same process and only after the synostosis of the sutures of the skull does the picture change and oxycephaly become manifest. Eighty-five per cent of his cases showed skeletal evidences of rickets. Meltzer had much the same experience, but in many cases reported there has been no evidence of associated rickets. Dock has remarked the paucity of information regarding syphilis in the histories of cases quoted to date. There is little evidence to show that meningitis causes irritation of the sutures, indeed the absence of associated mental defects is a contraindication. A congested condition of the contents of the skull giving rise to irritation has been advanced by Virchow. Fletcher has suggested developmental disturbance showing only in the skull. New bone formation has been suggested by Watts, who found ossification over the protruding membrane of the brain in one of his cases two years after a decompression. Pituitary disturbances have been suggested by Fletcher, who pointed out changes in the sella turcica. Hydrocephaly has been ruled out by comparison of the roentgenograms in these two conditions showing nothing

in common. Gudden's experiments showed that ligation of the carotid artery caused deformity of the skull without synostosis, while ligation of the jugular vein caused synostosis of the sutures without deformity of the skull. Bertolotti looks on oxycephaly as a lymphatic polyglandular dystrophy. Heredity is not considered a factor.

CLINICAL FINDINGS

Fletcher has described three distinct groups: (1) congenital, with the exophthalmos and cranial deformity present at birth, (2) change in the shape of the head developing in the first few months of life, and (3) a condition in which the patient is normal for the first few years, and the earliest signs appear between the second and the sixth years. In the collected cases in the literature the incidence has been largely in the male. In the four cases in the Mayo Clinic series it happens to be divided equally.

The symptom that brings the patient under medical attention is commonly impairment of vision. This may be present at birth, but is usually noted between the second and the sixth years. It may stop at certain degrees or go on to complete blindness. The blindness is due to a postneuritic atrophy. There are various theories with regard to the cause of the optic atrophy. Internal hydrocephalus has been seen, sometimes in three or four ventricles, and bone distortion, or even bone destruction, with alteration of the relations of the nerves and arteries. The arrest of the circulation of the fluids in the sheath and trunk of the optic nerves, has been accepted as the most probable cause. Schloffer devised an operation to attempt to overcome this. The choked disc preceding the atrophy is probably due to intracranial pressure. Anomalies and less of taste and smell occur as a result of local alterations at the base. Exophthalmos, owing to shortening of the orbital cavities by the pushing forward of the greater wings of the sphenoid to form their posterior in place of their lateral walls, is seen in more than 50 per cent of cases. It is often greater on one side than on the other. The lid symptoms of exophthalmic goiter are not seen. Strabismus, commonly divergent but occasionally convergent, is associated in the majority of cases. Nystagmus is frequent and the mobility of the globes is often limited. Cranial deformity is

characteristic, the forehead and anterior portion of the skull being unusually high. The increased height is usually in the frontal region, but it may be in the parietal. A projection corresponds to the sagittal suture and the apex is just posterior to the anterior fontanel. The parietal bones drop abruptly to the normal level and there may be a hollow on each side of the crest. The cranium is always wide in proportion to the length; the cranial cavity may be almost spherical; the vault is pointed; the two halves of the skull are usually symmetrical, but striking exceptions have been reported. Thickening or depressions along the line of the sutures may be seen. Obliteration of the superciliary ridges is often noted. Flattening of the malars, often unilateral, is common. The palate may be shortened and highly arched, cleft palate, anterior and posterior, has been noted, but is infrequent. Prognathism is often seen. The intelligence is unimpaired in oxycephaly, but many patients have an idiotic appearance. Headache, and occasionally convulsions, may occur in the active stages of the disease.

ROENTGENOGRAPHIC FINDINGS

The characteristic deformity described under clinical findings is seen in the roentgenogram. The contour of the bone is thinned and over the vault are seen putty-finger impressions due to an atrophy of the inner table and attributed to pressure by the convolutions. The suture lines are usually not seen. There may be an associated hyperostosis, either between the impressions or in other parts of the skull as in the ethmoid or in the sphenoid. The vessel markings are often widened and the vessel foramina enlarged. Areas of spontaneous decompression are sometimes seen, either in the parietal bones, where they may be large and symmetrical, or in the roof of the orbits. The frontal eminences are obliterated in the majority of cases, as are also the frontal and mastoid sinuses. The superior maxillary bones are poorly developed and the shallowness of the orbits is usually apparent. The sella turcica may be exceptionally well delineated; it is often enlarged and displaced backward. The base of the skull shows important changes; the fossae are usually deep and wide, the posterior fossa forming, in some cases, as much as two-thirds of the base. The middle fossa may be deepened, reaching in some

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cases a level as low as that of the posterior. The temporal regions are pushed outward so that the temporal fossae may be shallow or obliterated. Bertolotti described a type of *oxycephalic larvae* in which the changes in the skull are not so marked, but those of the orbits and base are diagnostic.

REPORTS OF CASES

Case 1 (A174495). A girl, aged eleven years, was brought to the Clinic because of abnormal development of the head, first noticed at the age of four. Birth delivery had been normal, she had walked and talked at the normal periods, and to all appearances had been a healthy baby. She had had "frontal headaches" "all her life," coming on after exertion and lasting for an hour or two. She had attended school since her sixth year and had made good progress. One brother and two sisters were living and normal.

Examination showed the biparietal diameter of the head to be greatly reduced with the frontal suture forming a sharp ridge and the height of the elevation at the site of the anterior fontanel. The palate was high and arched. The lower jaw was prognathic. The breast was markedly "pigeon" with Harrison's groove, the pelvis was narrow and funnel shaped; there was some scoliosis in the dorsal spine. The optic discs were reported pale, but within normal limits. The Wassermann test was negative.

The only available roentgenograms unfortunately cut off the vertex in the lateral view, but in the anteroposterior view the characteristic deformity was well shown (Figs. 1 and 2). The putty finger impressions were striking. The lateral sinus was greatly widened. The superciliary ridges were fairly well

maintained, but the depth of the orbits was lessened. There was no marked alteration of the sella or of the fossae of the base. The mastoid and frontal sinuses were not seen and the antra of Highmore were small and indistinct. The temporal fossae were obliterated and there was an apparent lack of development of the superior maxillary bones. The lower jaw was projected beyond the line of the upper.

Case 2 (A259660). A boy, aged 5 years, was brought to the clinic because of a deformed head. The deformity had been present since birth. He was a first child, and delivery had been normal. He had always been bright mentally and active in play. Nine months previously he had fallen from a chair and afterwards a small mass eight millimeters in diameter had been noticed in the left frontal region. This gradually increased in size. He had also had intermittent attacks of headache.

Examination revealed a large soft mass, 18 by 14 by 7 cm., in the left parietal region, covered with hair. The right temporal region protruded. There was bilateral exophthalmos, the right more prominent than the left, and nystagmus with divergent squint. The nerve heads were pearly white, the disc margins blurred, but without swelling. The Wassermann test was negative. There were four other children in the family, all normal. A diagnosis was made of incomplete optic atrophy.

The roentgenogram showed the characteristic deformity of the head (Fig. 3). The putty finger impressions were limited

to the frontal and anterior superior parietal regions. The frontal eminences were obliterated and there was no evidence of the frontal or mastoid sinuses. The superior maxillary bones were poorly developed. The base of the skull showed marked alteration, the posterior fossa was large and occupied the greater proportion of the basal area; the middle fossa was deepened and the sella was altered and difficult to identify. In the anterior portion of the middle fossa was a depression simulating the sella. The lateral sinus was two centimeters in width. The sphenoid bone was deformed lessening the depth of the orbital cavities. A large shadow overlying the parietal area suggested hernia of the cerebrum. The origin of this hernia could be traced to the posterior portion of the parietal bone where an area was seen that strongly suggested spontaneous decompression. The absence of putty finger impressions in the posterior two-thirds of the cranial vault rather corroborated the presumption of spontaneous decompression associated with the hernia. Over the latter half of the shadow could be traced a series of branching lines continuous with the bone; these were interpreted as commencing ossification over the protruding mass similar to the ossification noted by Watts in his case.

Case 3 (A369905). A girl, aged two and one-half years, whose head had been deformed since birth, was



Fig. 1—Case 1 (A174495)—Lateral view. Putty finger impressions of intracranial pressure. Prominent lateral sinus. Little evidence of mastoid cells. Lower jaw projected (prognathism). Sella apparently normal in size and position with depth of the orbits lessened.

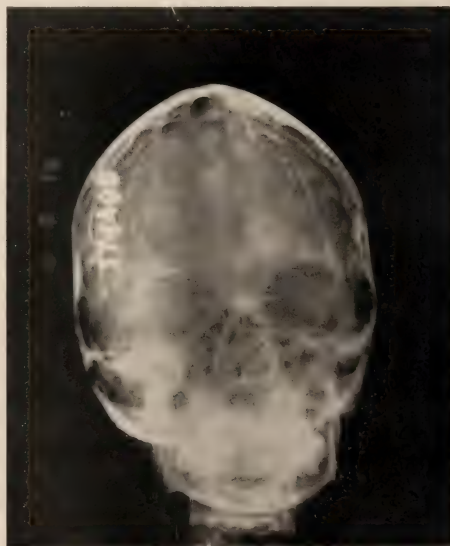


Fig. 2—Case 1 (A174495)—Anteroposterior view. Central ridge and bulging in the temporal region. No evidence of the frontal sinuses.

brought to the Clinic for consultation with regard to a cleft palate. The child had sat up at the age of six months; she had not walked but stood firmly and could climb well. She could say only a few words. Two brothers and two sisters were normal.

Examination revealed a cleft soft palate, widely separated peg shaped teeth and ptosis of both eyelids, but no exophthalmos. There was a hemangioma over the forehead about five centimeters in diameter. The optic nerves were pale, grayish, and blurred.

It was difficult to secure roentgenograms, and only one was suitable for reproduction (Fig. 4). The putty finger impressions were evident over the entire cranial vault. The base showed marked alteration, the posterior fossa occupying a major portion of the basal area, and the middle fossa was deepened almost to the level of the posterior.

Case 4 (A380861). A boy, aged five years, was brought to the Clinic because of a prominent forehead and exophthalmos, both of which had been present since birth. When he commenced to walk it was noticed that he was partially blind. He was the fourth child, and, while labor had been difficult, instruments had not been used. He had been breast fed, and, except for slight difficulty in breathing, he had developed normally. Three sisters and two brothers were normal. One uncle was known to have prominent eyes and strabismus.

Examination revealed the high forehead and characteristic ridge and protrusion at the site of the anterior fontanel. The profile of the face was flat. The teeth were irregular and

prognathism was marked. A Harrison's groove was detected at the lower end of the sternum. There was hypermotility of the hip and ankle joints. Vision was very poor. Bilateral simple optic atrophy, with divergent strabismus and nystagmus were present. The palate was high and arched.

Roentgenograms revealed the characteristic cranial deformity and the putty finger impressions (Figs. 5 and 6). The superciliary ridges were obliterated; there was no evidence of the frontal or the mastoid sinuses. The base of the skull was not markedly altered and the sella turcica appeared normal in size and contour. The temporal fossae were obliterated, bulging being quite marked in that region. Prognathism was striking.

PROGNOSIS AND TREATMENT

Unless the patient is seen early, irreparable damage will be done to the optic nerves. Various decompression operations, such as lumbar puncture, subtemporal (unilateral or bilateral) trepanation, ventricular puncture, and puncture of the corpus callosum have been done and at least temporary improvement has resulted. After blindness has occurred, operation cannot restore vision but may be useful for the relief of pain or other pressure symptoms. With advanced optic atrophy and no other pressure symptoms operation is not indicated, though Watts had encouraging results in such types of cases. Results from the canal operation of Schloffer in the hands of some operators have been encouraging. Briefly, if the patient is seen early there is hope of limiting the impairment of vision. Later, treatment is indicated only for pain or pressure symptoms.

NOTE—A number of important articles on the subject, not referred to in the text, are included in the bibliography.

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Fig. 3—Case 2 (A259660)—Lateral view. Characteristics of oxycephaly with large mass projecting from vertex. The bony strands over the posterior portion of the mass are continuous with the bone of the skull. Ossification in the lining membrane of the herniated mass is suggested.

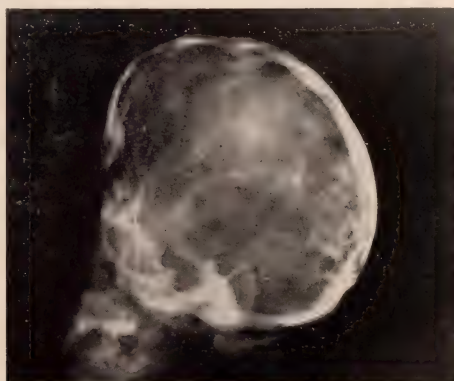


Fig. 4—Case 3 (A369905)—Lateral view. Characteristic deformity of the head and the putty finger impressions. Head somewhat angled and relations distorted. Apparent deepening of the middle cranial fossa so that it is almost on a level with the posterior.

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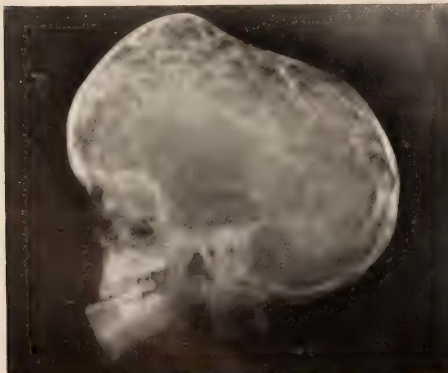


Fig. 5.—Case 4 (A⁸⁰⁸⁶¹)—Summit of the projection at the site of the anterior fontanel and the abrupt decline just posteriorly. The superior maxillary bones and the prognathic lower jaw apparently are underdeveloped. The sella turcica and fossae of the base appear normal.

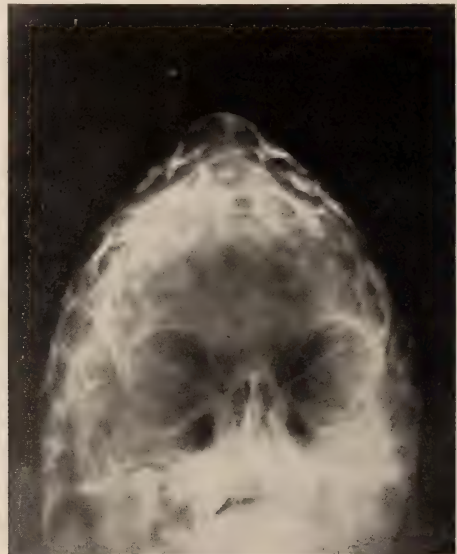


Fig. 6.—Case 4 (A³⁸⁰⁸⁶¹)—Anteroposterior view, showing the characteristic central ridge bulging in the temporal regions and absence of the frontal sinuses.

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Effect of Heavy Radiation on the Pleurae and Lungs*

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THE STUDY of the effect of radiation on the pleurae and lungs is becoming more and more important with the increasing use of radiation in the treatment of cancers of the breast. It is even more important in cases referred for treatment following surgical removal of cancer of the breast. It is more important in this type because any untoward action on the pleurae and lungs cannot be excused on the ground that the severity of the lesion demanded the treatment no matter what the after effects might be.

A careful search of medical literature has failed to find any article calling the matter to our attention. In fact, it has been only a few years since Dr. George E. Pfahler denied that x-radiation produced deleterious effects on the pleurae and lungs, saying that his experience had proved that all cases showing changes in the pleurae and lungs proved to be malignant metastases. We had held the same opinion until the past year. In a paper read by Dr. Russell D. Carman at the Boston meeting of the Radiological Society of North America in June, 1921, he discussed the roentgenological appearance of malignancy metastatic in the lung. He made the statement that malignancy never spread from the hilum outward. In the discussion he said pathologists informed him that malignancy never took this form.

A review of our cases showed greater frequency of this complication since the advent of heavier doses of more highly penetrating x-rays. We found that only three cases who had suffered from this complication had demonstrable metastases in the pleurae or

lungs at the time when they first came for treatment. All of the cases here discussed are those sent for postoperative irradiation for prophylactic purposes. Those suffering from demonstrable malignancy of the lungs or pleura have been purposely omitted.

PHYSICAL EXAMINATION OF THE CHEST

While the number of cases under consideration in this series is small, it has seemed to us that a report of the findings on physical examination of the chests of patients subjected to heavy radiation of the pleurae and lungs might not prove without interest.

The production of fibrous tissue in muscle which has been repeatedly exposed to the action of radiation is well known, and suggests that the same or a similar change may take place in the pleurae and lungs of patients treated for carcinoma of the breast by radiation when this is sufficiently prolonged or of sufficient intensity.

Believing that when structural changes in the lung and pleura have occurred, so pronounced as to be demonstrable radiographically, there should be changes from the normal physical signs, we undertook a careful study by physical examination of the cases reported. None of the cases studied, either on admission or during treatment, presented chest metastases.

The first change detected by us was manifested in the breath sounds, which became harsh and of a blowing character over the areas involved, even before there was any evident impairment of resonance on percussion. Two cases which later returned with pleuritis and effusion, on first examination, in addition to blowing breathing, had slight friction rubs. Harsh breath sounds was an early and constant characteristic in all cases in which there was a fibrotic change in the lung, this increasing in

intensity as the process in the lung progressed. The cases in which moderate effusion developed gave the physical signs of fluid only.

When what we have called the terminal stage, as represented by the third radiograph in each series, is reached, physical examination of the chest reveals the findings typical of a pneumonic consolidation. In each instance, physical and radiographic examination of the chests of these cases on admission, before radiation treatment was instituted, failed to disclose any evidence of what we have termed, "fibrosis in the lungs."

GENERAL DISCUSSION

The study of this condition is not only of importance from a therapeutic standpoint, but is extremely important from a diagnostic standpoint. We are under the impression that practically all of the men who have been finding these changes in the lung have been making the same interpretation that we did previously to the last year, that is, they have been calling these changes metastases into the lungs and pleurae when in reality they are fibroses produced by radiation.

It will be noted by making a detailed study of the x-ray findings as given under the case reports that a steadily progressive change takes place in the lungs and pleurae following radiation. It is surprising to notice how little radiation produced the change in some of the patients. Seven cases here reported show that the change was recognized in one case after 120 milliamperes minutes irradiation over the back of the chest. This dosage was given in two series, each series composed of 60 milliamperes minutes dosage. Out of these seven cases the one having the largest dose before changes were recognized, had 540 milliamperes minutes over the front of the chest and 190

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, Mo., May 20, 1922.

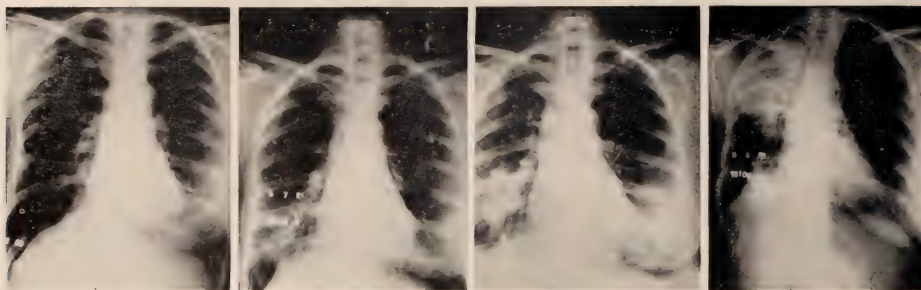


Fig. 1.—Case No. 14610—Mrs. J. F. A.—(1) Roentgenogram made at time of patient's admission before treatment was given, showing some increase in the right hilum. (2) First examination, showing increased density in the right lower lobe with limitation of movement of the inner half of the diaphragm.

(3) Roentgenogram made approximately two months later, showing marked increase in density in the right lower lobe. (4) One year later than No. 3, showing collapse of the lower part of the right lung and marked increase in density above the site of the collapse.

milliampere minutes over the back of the chest. The average for the seven is 257 milliampere minutes in front and 190 milliampere minutes on the back. From these figures it will be seen that the dosage which was given was really not as much as we frequently use in treating malignancy. We cannot explain why some patients develop these changes so much more quickly than others and under so much less dosage. It would seem reasonable to believe, however, that patients who develop this condition after radiation may have had some other disease of the lung which has become arrested and has sprung up following the radiation reaction.

We regret that at this time we are unable to report necropsy findings in any of these cases. We have had two deaths which are not reported in this series, both of them having definite metastases in the lung. There has been only one death in cases where metastases were not demonstrable. Some of the cases are living for a considerable

period of time since the changes in the lung were first recognized.

Clinical effects of these changes: When the patients develop these changes in the lungs and pleura the first thing to which they call attention is usually a pleuritic pain characterized by stabbing on inspiration. Physical examination at this time will show a friction rub. This goes on for a time when one will be able to recognize radiographically a thickening of the pleura at the site of the pain, together with a beginning change along the bronchi, extending from the hilum out to the periphery at the point where the pleura is thickened. This will naturally have the fan-shaped appearance of the normal anatomical structures of the lung. As the process continues the patient gets sufficient involvement of the lung to interfere with its function. In more advanced cases the patient becomes cyanotic, suffers from dyspnea and cardiac embarrassment. Cardiac embarrassment is more marked where changes have been found in the left side and we think that this is due to

the fact that pleuropericardial adhesions form at the same time that adhesions form between the visceral and parietal layers of the pleura. The diaphragmatic pleura also becomes adherent and as the changes advance and the contracting changes take place, the lung is actually pulled inward away from the chest wall at the points where the pleura is not adherent. At the same time the diaphragm is pulled upward and rendered immovable. In cases where the visceral and parietal pleurae have become densely adherent the hilum of the lung will move outward toward the chest wall. This is especially well demonstrated in case number 14655. By careful inspection of the x-ray plates of this patient it will be noticed that the left bronchus is pulled upward and outward so that it shows well beyond the heart and great vessel shadows.

During the earlier part of these changes the patient is considerably embarrassed and not able to go about. After the changes have become more or less well established and the patient has become accustomed to depending upon the opposite lung she is able to get about and to perform her ordinary duties.

In the terminal stages the intercostal muscles become depressed and the intercostal space on the affected side narrowed. At the same time a lateral curvature of the spine occurs, the concavity being toward the affected side. In some cases the muscles of the chest wall become hard, fibrotic and inelastic.

CONCLUSIONS

From the facts enumerated above it would seem that we are justified in drawing the following conclusions: First, prophylactic irradiation of the chest following surgical removal of the breast should, as a rule, be carried out with what might be called, "superficial technique"; that is, instead of using

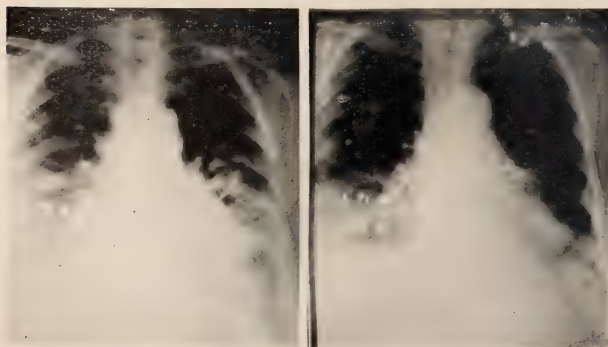


Fig. 2.—Case No. 14393—Mrs. E. C.—(1) Roentgenogram made when increase in density in the left lung was first recognized. (2) Same patient after the area of increased density had subsided, leaving only a small area of fibrosis.

the high voltage for this work we should use the low voltage and thin filters. We feel that it is unwise for us to repeat the dosage more than two or three times. Second, it would appear that the high voltage technique should be reserved only for inoperable cases of carcinoma of the breast. Third, we feel that this pathology should be definitely recognized by the medical profession so that these patients will not be mistreated by being given more radiation after these changes are manifest. Knowledge of this pathology will also influence the prognosis in this type of case.

TABLE SHOWING DOSAGE USED IN THE CASES REPORTED

Dose Given Before Charge Recognized				Total Dose			
Front	Back	Front	Back	Front	Back	Front	Back
Ma.	Min.	Ma.	Min.	Ma.	Min.	Ma.	Min.
120	2	120	420	540			
360	4	210	540	300			
150	2	150	330	300			
180	2	210	300	300			
180	2	180	330	180			
270	3	270	870	882			
540	6	190	912	340			

Average 257 190 529 406

The following detailed case reports show the changes in the lungs and pleurae from their earliest recognition progressively to the time of the last observation.

Case No. 14610 (Fig. 1)—Mrs. J. F. A. 57 years of age. Admitted October 11, 1920.

Diagnosis: Carcinoma of the right breast.

Her family history is negative.

Her personal history also is negative.

Present Illness: Five years ago the patient noticed a lump in the upper, outer quadrant of the right breast. The right breast was amputated in September,

1919. A recurrence in the scar was removed in September, 1920.

X-ray Findings: October 11, 1920, there was no evidence of metastases in the lungs. March 7, 1921, a considerable area of fibrosis extended into the right lower lobe. May 1, 1921, the area of infiltration in the right lower lobe extended from the fourth to the seventh ribs anteriorly. September 30, 1921, there was an extensive area of consolidation, probably a fibrosis, in the right lung, extending from the second to the fifth ribs anteriorly, with thickening of the pleura over the right apex. Pleurodiaphragmatic adhesions were found on the right side, but no movement.

Physical Examination: November 14, 1921, there was dullness and bronchial breathing over the middle and right lower lobes, also evidence of consolidation.

X-ray Examination: November 15, 1921, there was an area of increased density under the right scapula from the second to the sixth ribs in the mid-scapular line. This bulged inward like a localized accumulation of fluid in the pleural sac. There was an area in the right lung central to this. The trachea and all of the mediastinal structures were drawn over to the right. There was thickening of the right pleura over the apex and base.

Physical Examination: January 10, 1922, classical physical signs of consolidation were in the entire upper and middle lobes of the right lung. There was dullness, increased vocal and tactile fremitus, and bronchial breathing.

X-ray Examination: January 10, 1922, the pleura was thickened over the entire right lung. The right middle lobe shows evidence of fibrosis along the bronchi extending out from the

hilum in a fan shape. There was a mass projecting inward from the chest wall in the right posterior axillary line extending from the second to the fifth ribs. February 16, 1922, in addition to the above there was marked thickening of the pleura over the right lower lobe. The right diaphragm did not move. There was no evidence of fluid.

X-ray treatment, which was given up to the time the lung changes were demonstrable: 9¾ inch spark gap, 6 millimeters of aluminum and sole leather. 6 milliamperes, 10 inch anode-skin distance through multiple small ports of entry, 120 milliamperes minutes posteriorly and 120 milliamperes minutes anteriorly. The total dosage was 540 milliamperes minutes posteriorly and 420 milliamperes minutes anteriorly.

Case No. 14393 (Fig. 2)—Mrs. E. C. 69 years of age. Admitted September 13, 1920.

Diagnosis: Carcinoma of the left breast.

Her family history was negative.

Personal History: About eight years ago the patient developed what she thought was an eczema of the left nipple. Under instructions from a friend, she repeatedly scrubbed this with a stiff tooth brush. The condition gradually grew worse until one year ago, 1919, a bleeding presented itself which has continued to September 13, 1920. Recently the patient noticed shooting pains and found some lumps in her left axilla.

Physical Examination: There was an ulcerating cauliflower growth two and a half centimeters in diameter involving the left nipple area, the nipple having been destroyed. There were palpable left axillary glands. She was referred for surgical removal of the breast.

Microscopical Report: Basal cell carcinoma.

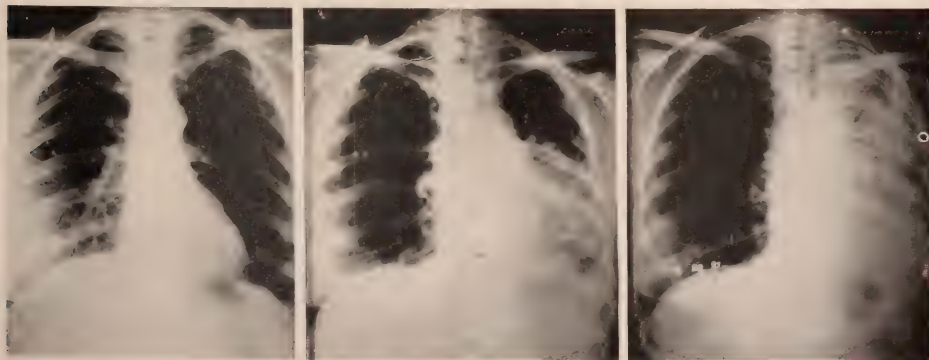


Fig. 3.—Case No. 14520—Miss S. F.—(1) Roentgenogram made at time of admission, before treatment was given, showing no increase in density in the left lung. (2) After treatment was given, showing

marked increase in density involving the left lower lobe. (3) Same patient still later, showing increase in density throughout the whole left lung.

X-ray Examination: September 13, 1920, there was no demonstrable pathology in the lungs, pleura or ribs. March 22, 1921, an area of infiltration in the left lung extended out from the hilum in fan shape under the third to the fifth anterior ribs. This has the appearance of fibrosis. April 27, 1922, the area of infiltration shown above had disappeared with the exception of a small area in the third interspace.

X-ray treatment which was given up to the time the lung changes were demonstrable: $9\frac{3}{4}$ inch spark gap, 6 millimeters of aluminum and sole leather, 6 milliamperes, 10 inch anode skin distance, 360 milliamperes minutes anteriorly and 210 milliamperes minutes posteriorly. The total dosage was 640 milliamperes minutes anteriorly and 300 milliamperes minutes posteriorly.

Case No. 14520 (Fig. 3)—Miss S. P., 50 years of age. Admitted October 30, 1920.

Diagnosis: Carcinoma of the left breast.

Family History: Her mother died of asthma, her father of tuberculous enteritis.

Personal History: She had had one menstrual period in the year previous. Twenty years before she had had typhoid and also appendicitis.

Present Illness: Radical amputation of the left breast was performed August 24, 1920. Cervical glands were removed one week later. October 16, 1920, she had an attack of severe pain in the left chest, which increased on deep inspiration, accompanied by chills and fever. This cleared up in a few days.

X-ray Examination: December 20, 1920, the lungs, pleurae and ribs were negative for new growth. February 24, 1921, the entire lower lobe of the left lung was infiltrated. The peri-

cardium was adherent to the pleura in the region of the auriculoventricular junction. The whole mediastinum showed infiltration. April 4, 1921, practically the entire left lower lobe was infiltrated. The heart was misplaced so that the right border rested at the left of the spinal column. May 2, 1921, considerable infiltration showed in the right lower lobe. May 15, 1921, as above, the lower lobe of the left lung was involved and there was then some fluid in the left pleural sac. September 1, 1921, the pleura over the entire left chest was greatly thickened. The lower three-fourths of the left lung field was radiopaque. The left diaphragm was fixed. The costophrenic sinus was obliterated. November 26, 1921, there was no fluid demonstrable in the left pleural sac. The pleura was markedly thickened throughout. The lung showed fibrosis extending out from the hilum along the bronchus. The heart and great vessels were drawn over into the chest. There was no movement of the left diaphragm. Air entered the entire left lung.

X-ray treatment which was given up to the time the lung changes were demonstrable: $9\frac{3}{4}$ inch spark gap, 6 millimeters of aluminum and sole leather, 6 milliamperes, 10 inch anode-skin distance through multiple small ports of entry, 150 milliamperes minutes anteriorly, 150 milliamperes minutes posteriorly. The total dosage was 330 milliamperes minutes anteriorly, and 300 milliamperes minutes posteriorly.

Case No. 15012 (Fig. 4)—Mrs. E. C., 47 years of age. Admitted December 20, 1920.

Diagnosis: Carcinoma of the right breast.

Her family history was negative.

Her personal history was negative.

Present Illness: A tumor was removed from the outer half of the right

breast in 1918. In 1919 there was a recurrence near the scar. On November 16, 1920, a radical removal of the right breast was done.

Microscopical Examination. Adenocarcinoma.

Physical Examination: Negative.

X-ray Examination: December 20, 1920, there were no demonstrable metastases in the lungs, pleurae or ribs. May 26, 1921, there was extensive infiltration in the mediastinum with areas of consolidation in the right lung from the second to the fourth interspace. June 30, 1921, there was still infiltration in the region of the right hilum, but less marked than at the last examination. August 16, 1921, there was an area of consolidation in the central portion of the right lung extending from the second to the fifth ribs anteriorly. There was no movement of the right diaphragm.

X-ray treatment which was given up to the time the lung changes were demonstrable: $9\frac{3}{4}$ inch spark gap, 6 millimeters of aluminum and sole leather, 6 milliamperes, 10 inch anode-skin distance through multiple small ports of entry, 180 milliamperes minutes anteriorly, 210 milliamperes minutes posteriorly. The total dosage was 300 milliamperes minutes anteriorly and 300 milliamperes minutes posteriorly.

Case No. 16291 (Fig. 5)—Mrs. A. B., 47 years of age. Admitted July 9, 1921.

Diagnosis: Carcinoma of both breasts.

Her family history was negative.

Personal History: At 16 years of age she had malaria, tonsillitis and oral infection.

Present Illness: In 1916 the left breast was amputated for carcinoma. A tumor was enucleated from the right breast at the same time. A short time

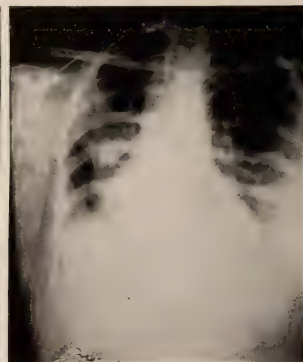
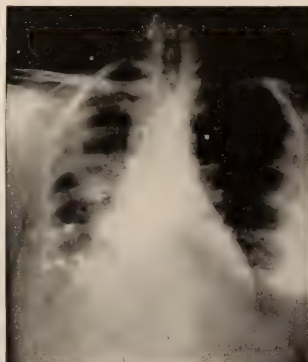
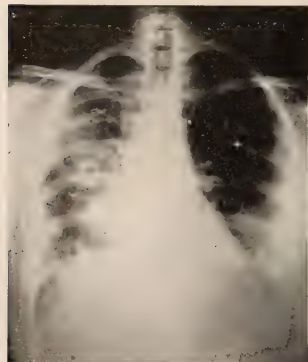


Fig. 4—Case No. 15012—Mrs. E. C.—(1) Showing marked increase in density in the right lung after treatment had been given. (2) Showing diminution of the size of the area of increased density, elevation

of the diaphragm and beginning contraction of the lung. (3) Showing marked contraction of the lung and fixation of the right diaphragm. The area of increased density is still present.

ago she noticed a lump in the right axilla.

Physical Examination: There were palpable glands, two and a half centimeters in diameter, in the right axilla.

X-ray Examination: July 9, 1921, there was no demonstrable new growth in the mediastinum, pleurae, ribs or spine. October 20, 1921, the right lobe was filled with many small areas of consolidation. These extended out along the bronchi and gave an appearance similar to influenza pneumonia. There was no movement of the right diaphragm. January 10, 1922, there was marked thickening of the right pleura anteriorly from the third rib down to the diaphragm, and outward to the anterior axillary line. There were several small areas of smoky white appearance which we thought were areas of consolidation. There was partial collapse of the right lung.

X-ray treatment which was given up to the time the lung changes were demonstrable: $9\frac{3}{4}$ inch spark gap, 6 millimeters of aluminum and sole leather, 6 milliamperes, 10 inch anode-skin distance through multiple small ports of entry, 180 milliamperere minutes anteriorly and 190 milliamperere minutes posteriorly. The total dosage was $11\frac{1}{2}$ inch spark gap, 1 millimeter of aluminum, $\frac{1}{2}$ millimeter of copper, 6 milliamperes, 14 inch anode-skin distance, 150 milliamperere minutes over one area covering the right chest, together with the 180 milliamperere minutes anteriorly and 180 milliamperere minutes posteriorly with the low voltage technique as described above.

Case No. 15010 (Fig. 6)—Mrs. J. W., 60 years of age. Admitted December 20, 1920.

Diagnosis: Carcinoma of the left breast.

Her family history was negative.

Personal History: She had malaria in childhood, tonsillitis and oral infection.

Present Illness: The left breast was amputated on November 8, 1920. Three weeks later she had two x-ray treatments.

Physical Examination: Negative.

X-ray Examination: December 20, 1920, there was an area of bone destruction (metastasis) three-fourths of an inch long involving the lower half of the anterior portion of the left third rib. April 4, 1921, there was infiltration in the left lung extending outward, upward and forward toward the metastasis in the rib. There was also infiltration outward and downward into the right lower lobe. May 9, 1921, there was an area of infiltration in the left lung under the third rib, which appeared less dense than at previous examination. June 21, 1921, there was still an area of infiltration in the left lung under the third rib and quite an extensive area of infiltration extending outward and downward in the left lower lobe. August 2, 1921, the infiltration in the left lung was considerably increased. The diaphragm was fixed and there were adhesions between the pleura and the pericardium. November 1, 1921, marked fibrosis extended out from the mediastinum into the left lower lobe and also into the left upper lobe under the left third rib anterior. The pleura was markedly thickened over the left base. December 14, 1921, there was thickening of the pleura over the left base, and infiltration out from the hilum with fibrosis in the lung under the left second rib anterior. January 20, 1922, the right lung was clear. The left lung showed marked thickening of the interlobar pleura, also the pleura over the left base. March 15, 1922, the major

portion of the left lung field was occupied by what appeared to be thickened pleura, having the same shape as that found in pleural effusion. The left upper lobe was clear.

X-ray treatment which was given up to the time the lung changes were demonstrable: $9\frac{3}{4}$ inch spark gap, 6 millimeters of aluminum and sole leather, 6 milliamperes, 10 inch anode-skin distance through multiple small ports of entry, 270 milliamperere minutes anteriorly, and 270 milliamperere minutes posteriorly. The total dosage was $11\frac{1}{2}$ inches spark gap, 1 millimeter of aluminum and $\frac{1}{2}$ millimeter of copper, 6 milliamperes, 14 inch anode-skin distance, one large port of entry covering the front, one large port of entry covering the back, 300 milliamperere minutes anteriorly, and 300 milliamperere minutes posteriorly, together with 570 milliamperere minutes anteriorly and the 582 milliamperere minutes posteriorly given with the low voltage technique described above.

Case No. 14655 (Fig. 7)—Mrs. S. M. W., 69 years of age. Admitted October 18, 1920.

Diagnosis: Carcinoma of the left lobe of the thyroid.

Her family history was negative.

Personal History: She was operated upon in 1910 following trauma of the right tibia. At 35 years of age she had a double oophorectomy performed.

Present Illness: June, 1919, she noticed a swelling in the left side of the neck in the region of the thyroid. It gradually grew until in October, 1920, it was the size of the fist. Then pain developed behind the left ear and along the ulnar side of the left hand, involving the ring and little fingers.

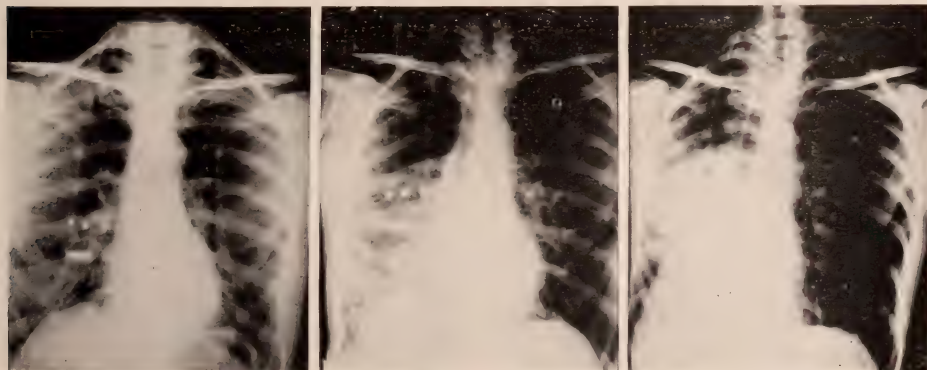


Fig. 5—Case No. 16291—Mrs. A. B.—(1) Roentgenogram made of the chest before treatment was given, showing some infiltration along the bronchi in the right lung. (2) Three months later, showing in-

creased density of the lower half of the right lung. (3) Still later, showing contraction of the right lung and increase in density in the lower half.

Physical Examination: There was a boardlike mass in the left side of the neck in the thyroid region, extending down to the left clavicle and below and behind it. There was hyperesthesia involving the left ring and little fingers. No demonstrable metastases were found in the lungs.

X-ray Examination: October 18, 1920, there was no demonstrable pathology in the lungs, pleurae or ribs. June 14, 1921, extensive infiltration extended from the mediastinum outward into the left upper lobe. There was considerable thickening of the pleura in the left upper lobe. September 27, 1921, the pleura was thickened over the entire upper left lobe. Infiltration from the left hilum to the periphery was more dense than at the last examination. November 23, 1921, massive fibrosis involved the upper lobe of the left lung. The trachea was drawn slightly over to the left. February 21, 1922, there was no demonstrable new growth in the bones. There was still fibrosis involving the left upper lobe, with retraction, and no movement of the left diaphragm.

X-ray treatment which was given up to the time the lung changes were demonstrable: 9¾ inch spark gap, 6 millimeters of aluminum and sole leather, 6 milliamperes, 10 inch anode-skin distance through multiple small ports of entry, 540 milliamperes minutes anteriorly, and 190 milliamperes minutes posteriorly. The total dosage was 912 milliamperes minutes anteriorly and 340 milliamperes minutes posteriorly.

DISCUSSION

DR. GEORGE E. PFAHLER, *Philadelphia*: I appreciate the paper of Dr. Tyler, but I think we must be careful

about drawing conclusions. He has had no autopsies and I think we all saw as the pictures were thrown on the screen that the chest plates at the beginning of treatment, which he called normal, had the beginning of the lesions when he started the treatment. We probably have been wrong in calling that malignant. I am willing to concede that, but it has not been proven, and that the process is there before we start treatment there can be no doubt. I am studying and have studied this and am thoroughly convinced. Every patient who comes in for treatment of carcinoma of the breast gets a film before we start and there are repeated films for months and years afterward, and in all those cases in which these fibrotic processes have developed I have been able to take these plates and trace them right back to the first day, and show that they had begun before the patient came to the office and before they had any treatment.

I think there are two possibilities: First, that we may have a malignant process that is changed into fibrotic tissue; second, that we have a fibrotic process and for some reason the rays stimulate that process. I do not know which of these is correct, but that the condition is there before beginning treatment there is no question and I think we must be careful about taking on to ourselves the blame for producing this and scaring patients away, or scaring patients about the pre-operative or post-operative treatment. Let us investigate this, but let us be careful about drawing conclusions.

DR. THOMAS A. GROOVER, *Washington, D. C.*: This is a subject in which we have been considerably interested for something more than a year and a half, and one to which we called

attention before the radiological section of the Southern Medical Association last November.

Our observations coincide in a general way with those reported by Dr. Tyler and we are rather convinced that the x-ray either causes these changes in the lungs or else has something to do with the development and spread of metastatic foci therein. These changes begin, as a rule, at about the time of the occurrence of the skin reaction. The patient will develop an irritative, unproductive cough about ten days after treatment, and if you will examine the chest at about that time you will see an infiltration beginning, as a rule at or near the hilus, which may spread quite rapidly and in the course of a few weeks involve practically the entire lung. The roentgen picture is not unlike that we sometimes see in influenzal pneumonia. In other instances pleural changes appear to predominate. If these are due to metastatic malignancy, they seem to pursue an entirely different course from that observed in untreated cases. We have cases in which the most critical study fails to show any pathology in the chest antedating treatment.

It is not unreasonable to believe that some change would occur in the lung as a result of intensive roentgen treatment. You may have noticed that in treating lesions about the face the reaction is sometimes more marked on the mucous membrane of the mouth than on the skin. The mucous membrane becomes of a whitish color and has much the appearance of a carbolic acid burn. It is not unreasonable to suppose that similar changes may occur in the pleura or in the lung itself.

In a recent case where we gave a massive dose over the face for malignant disease of the antrum the entire

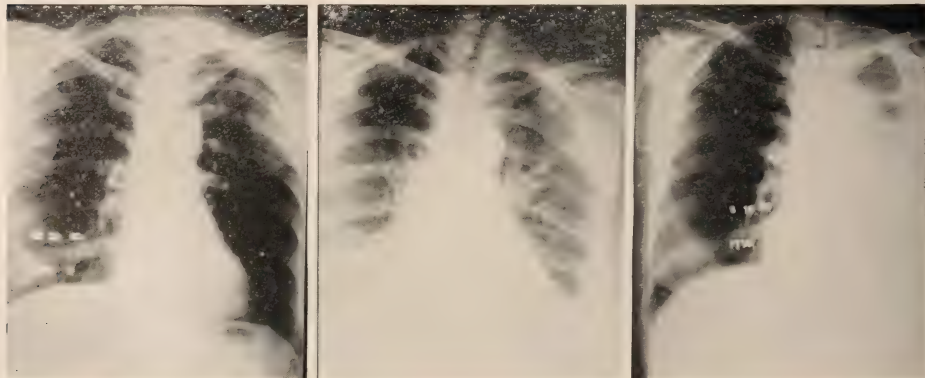


Fig. 6—Case No. 15010—Mrs. J. W.—(1) Roentgenogram made at time of admission, showing no increase in density in the left lung. (2) Showing beginning increase in density in the central portion of the left

lung and in the base, with pericardial thickening and fixation. (3) Increased density involving practically the whole of the left lung.

mucous membrane of the mouth and pharynx showed a marked reaction. This reaction was even more intense on the mucous membrane than on the skin. We believe that the x-ray may produce definite changes in the lung. Certainly the changes Dr. Tyler has referred to seem to be definitely related to the treatment, at least in certain cases, independent of a pre-existing cancer focus. Whether the x-ray causes them is a problem that remains to be solved.

DR. JAMES T. CASE, *Battle Creek, Michigan*: It was my intention to communicate to this society last December some of our observations on this point, but I was so unfortunate as to have to undergo an emergency operation and was unable to attend the meeting. I, with my associate, Dr. Pritchard, have been very much interested in some of these lung changes. We have no post-mortem records to show you, but we have seen many changes such as have been referred to by Dr. Tyler and Dr. Groover. I have had the privilege of going over the plates of Dr. Groover's cases, and I have come to the conclusion that all the changes demonstrated in the plates of Dr. Tyler can be accounted for by pleural irritation. They are very similar to the changes we see in patients when they first present themselves for x-ray treatment, especially those who have recurrences in the lung. I believe that these changes are for the most part pleural reactions, and I agree with Dr. Tyler in his assumption that some of the changes are of pneumonic nature.

I wish to report that we have been led by our experience to exercise special precautions in all our cases undergoing

radiation therapy for disease of the thorax, during the week or so following treatment, to protect them from draughts or chills or any other influence that might bring on pneumonia. We have been struck with the rather large number of patients who have developed pneumonia or a respiratory affection within a week or two following the radiation. We have had three cases that developed influenza within two weeks following radiation. Two of these cases developed in towns where influenza was epidemic, one fatal case in a small village where one in four had influenza. We are all well acquainted with the chronic indurating edema which affects the skin of patients who have been over-radiated, and I believe that the changes which occur in the lung and pleura following radiation are very likely of this edematous type. These changes are of the chronic, indurative type which we see in the skin and they may be also pneumonic.

The curious thing is that we do not find more patients showing the definite x-ray findings following radiation. We have treated many cases, but we have only four, three influenzas and one pneumonia, so far as we know. We have had some trachitis and other signs of upper respiratory affection in a number of our cases.

I think, as Dr. Pfahler has said, we must be careful in drawing conclusions, but that the upper respiratory tract shows changes following radiation I think we must admit and we must protect our patients against it.

DR. TYLER (Closing): Regarding the discussion of Dr. Pfahler, I notice he did not report any postmortem findings, and neither did Dr. Case, and I

did not, and that is the characteristic difference between this and malignancy. You get postmortem examinations in malignancy of the lung, but not in this condition. Dr. Pfahler said that these changes show in the chest before treatment. Why do not all of them get it? They do not, there are just certain ones that get it. We have some who develop effusion in the lungs after treatment. Perhaps, as Dr. Case said, this was due to the fact that they caught cold, or had an influenzal infection afterward. This fluid when drained off from the chest is not bloody, as it would be in malignancy, but clear, straw-colored fluid. The fact that we have an opportunity to make post-mortem examinations of the hollow viscera gives us an opportunity to find out what happens to the hollow viscera, and I take it that the lung is as sensitive at least as the skin, or probably more sensitive. I presented this paper as a preliminary report, hoping for a lot of discussion, because it is a problem for all of us. I hope to get some post-mortems, and then we will have some proof. The explanation, perhaps, might be that we had developed an irritation of the lung and air passages and that following that the patient was subject to influenzal attacks, etc., and that in the healed portions the parenchyma of the lung changes from its normal air-filled type to fibrous tissue. You can demonstrate this on the x-ray plate and by physical examination. Every patient reported here has had repeated physical and x-ray examination, with stereoscopic pictures and all the careful study any man gives, but we have not yet solved the problem to our satisfaction. We hope some of you will.



Fig. 7—Case No. 14655—Mrs. S. M. W.—(1) Roentgenogram made at the time of admission, showing no change in the upper half of the left lung. Increased density at the extreme upper portion of the illustration is due to a malignant tumor of the left lobe of the thyroid. (2) Marked increase in density in the

upper half of the left lung. (3) Still more marked increase in density of the upper portion of the left lung, with retraction of the trachea toward the left and elevation of the main bronchus. The heart shadow is now entirely to the left of the midline.

Does Radiation Enhance Postoperative Recurrence of Carcinoma of the Breast*

M. J. SITTENFIELD, M. D.
New York City, N. Y.

CARCINOMA of the breast exacts each year a toll of about 50 per cent of the individuals thus afflicted, and since these cases are numbered by the thousands, it is of intense interest to consider conditions which have an important bearing upon improving these unfortunate end-results. Up to the present there are but two concurrent methods of dealing with carcinoma of the breast, surgery and radiotherapy. It is unquestionably true that surgery deals effectively with some cases, it is equally true that radium and x-ray radiation bring about the clinical arrest of the disease in others. Is it too much to expect, therefore, that perhaps an intelligent combination of the two may not exert a better influence upon the ultimate outcome of these cases?

You will permit me, perhaps, to digress for a moment in order to lead up to the point in question. From time to time one hears statements and reports, such, for instance, as those of Perthes and Tichy, and others who speak from insufficient experience and incomplete data, that the incidence of postoperative recurrence following radical excision of carcinoma of the breast is considerably increased by prophylactic radiation. In view of the importance that may be attached to this very question, it seems to me that a careful analysis and study of this subject is warranted. If postoperative radiation be attended by such hazardous risks, as is claimed by some, then it is distinctly harmful and dangerous, and should be cast aside in favor of surgery alone. On the other hand, if in the experience of competent radiotherapists the end-results of carcinoma of the breast following postoperative radiation show a greater percentage of clinical arrest of the disease, then such misstatements and reports as those I have mentioned should be put to rest at once, and ways and means devised to bring this knowledge home to each surgeon and physician who shares responsibility for the proper care of these patients.

In the first place surgical technique in cancer of the breast is about fifty years old, and whilst new technical refinements are evolved constantly, unfortunately the further outlook for im-

proved radical surgical excision of the disease does not inspire any one with undue hope. The postoperative results familiar to us at present are none too satisfactory. For instance, at a meeting of the American Surgical Society at Washington, where the end-results of cancer of the breast were discussed, less than three weeks ago, it was brought out that the three year recoveries by surgery were 51 per cent, and that after five years about 70 per cent had succumbed. These figures correspond with reports from Sistrunk of the Mayo clinic, and others, that about 78 per cent of the cases of carcinoma of the breast do not survive the five year period, and those that do survive represent in a great measure the optimum surgical risk. They were cases of early localized tumors, with no glandular involvement at the time of operation.

It is perhaps pertinent to mention right here that statistics, as a general rule, are a very unfair criterion, as we are speaking constantly of a collection of unlike things. So many different factors, that is, the extension of the disease, its duration since its incipency, the biological behavior, etc., enter into this complex collection that it is impossible to assume them to be all of the same kind or put them into one group.

Therefore it is not fair to use these statistics as a means of primary proof of a fact. They do not allow definite deduction as they can not be classified uniformly. In other words, figures mean little, and must be taken for what they are worth unless specifically qualified. To demonstrate, in the first place whilst as a general rule the tumor cell, microscopically or clinically, possesses the characteristics and peculiarities of its parent cell, on the other hand its degree of malignancy varies entirely, and is dependent either upon the resistance or susceptibility of the entire organism. Of importance in this connection is the distribution and duration of the disease since its incipency, also the extent of the involvement of adjacent structures, the involvement of glandular tissue, either in the axilla or neck or thorax, and most important is the difference in the biological behavior of one particular tumor from that of another.

For instance, in the consideration of the varied clinical manifestations of carcinoma of the breast, we are confronted with the following factors: In

the one case it presents itself as a local condition, and remains local and stationary for a number of years, without the slightest general disturbance, and to all intents and purposes it is very slightly malignant until metastases occur elsewhere. In another group of cases, the growth though it starts as a localized tumor, spreads more or less rapidly either by extension along the lymphatics or blood stream, and springs up in different parts of the body. There is still another group in which the tumor develops perhaps in more than one site in the same breast; these different foci continue to grow and form eventually one large mass. Finally in the fourth group the malignancy starts in one breast, and then affects the other, either after a very short interval, or almost at the same time. It spreads very rapidly throughout the body, and invariably ends fatally in a comparatively short period.

There are, however, a number of instances, especially in old people, in whom growth energy is reduced to a minimum, where the tumor may remain stationary for years. Particularly is this true of tumors which are not very cellular but are abundant in fibrous tissue, for as a general rule fibrous tissue tumors grow very slowly and simulate an attempt on the part of nature to retard the growth. Contrast this to the rapidly metastasizing group, analogous to the pyemic conditions of an infection. Here also we see the defensive or resistant mechanism of the organism so exhausted that it is practically powerless to stop or limit the growth energy of the malignancy. Unfortunately this happens all too frequently in the majority of cases of carcinoma of the breast.

This brings up the therapeutic consideration of the group of cases in which the tumor is local or remains local in the breast. This type, especially, lends itself very favorably, both anatomically and surgically, to radical excision, not only of the local tumor but also of the large field of threatened dissemination. These are the most promising cases prognostically, and offer absolute indication for early surgical interference. Recoveries and cures in this class of cases are of the optimum proportion.

It is regrettable as well as reprehensible that the majority of cases of cancer of the breast do not present themselves or seek advice at this period,

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May 20, 1922.

but delay far too long. It is astounding in this connection that this applies not only to the ordinary patient, but to the wives and other members of physician's families. Let it again be repeated that it is essential to bend all efforts toward an early diagnosis. To temporize in any one of these cases forces it to be classed in the second group, where slow spreading and dissemination has already set in. In this group surgery used alone fails to remove all vestiges of tumor cells, no matter how wide and thorough the dissection be carried out. All surgical statistics are one where axillary or other lymph nodes are involved, namely, the number of women who survive the five year period is less than 30 per cent.

These are the very cases in which surgery plus postoperative radiation is of necessity indicated. Radiotherapy during the past two or three years has attained new heights, and as the result of this only intensive radiation is at present practiced, and with it accurate determination of a definite skin tolerance dose and its absorption in the deeper tissue is aimed at. So, too, the secondary scattering is carefully reckoned with, for all this makes for a better dosage quotient. It is pretty well recognized at present that the higher the voltage of a given apparatus, the greater will be the output of short wave radiation, and consequently a larger percentage of harder rays quantitatively as well as qualitatively. Again the harder the ray the better will be the absorption coefficient; and the greater the amount of radiation that passes into the depth, the greater the scattering and hence the greater the biological effects. To gain a better understanding of the importance of high voltages, it should be borne in mind that the increased radiation is in proportion to the square of the voltage, that is, if we compare the relation of the 140,000 or 150,000 volt apparatus to the modern 220 kv. machine, the proportionate energy output is not a 40 per cent increase, but in the proportion of 1 to 2. With this enormous increase of radiation intensity of rays of short wave length the physical and biological effects are materially improved.

There is abundant evidence at hand clinically and experimentally that a definite amount of radiation exerts a definite influence, biological as well as pathological, upon cancer cells. Experiments, which I reported three weeks ago at the American Association for Cancer Research, upon the influence of tumor growth in animals by means of radiated tumor emulsion, proved that an emulsion of Flexner-Jobling Rat Tumor which was radiated with one or two skin erythema doses, failed to show

upon re-inoculation, whilst in the control animals which were inoculated with the same emulsion unirradiated, the tumor grew in 34 out of 43 inoculations.

My own clinical observation since the advent of the modern technique of intensive radiation within the past twenty months, has impressed it upon me that pre-operative or postoperative radiation with proper technique will bring about much more gratifying end-results. This has prompted me to correlate my own experience with that formerly obtained by surgery alone. Therefore, I wish to report 73 cases briefly as the detailed protocol of these is being prepared for another communication.

In this report 73 cases of carcinoma of the breast treated by intensive radiation within the past twenty months are grouped as follows: Of this number 15 received pre-operative radiation and were operated upon twelve to fifteen days subsequently. In the majority of instances the pathological report read that the tumor *per se* had diminished considerably in size, in one case it had disappeared entirely upon gross inspection, and microscopical examination revealed necrotic or degenerated cells, showing simply a faint outline of the membrane of the cell without protoplasm or nucleus. In none of these has there been a recurrence so far. Of course, the time limit is far too short to claim any permanent results, however, at present, all of these 15 are clinically free of the disease. Of 23 other cases that received postoperative radiation, in all but 2 the disease is clinically arrested. Repeated radiographic examinations reveal no manifestation of the disease elsewhere. Nine months subsequent to the primary radiation one case developed metastases in the hip, which yielded to intensive ir-

radiation, the local recurrences have disappeared and the disease is seemingly arrested.

In conjunction with this group of 12, there were 8 others who at the time they first sought relief presented extensive glandular involvement, and in 2 cases there was ulceration and necrosis of the entire breast. These were all inoperable. Of these 8, 2 cases were rendered operable, and it seemed wise to give them the benefit of radical surgical excision of the breast, which was followed by intensive post-operative radiation. The other 6 were radiated only. Four are still alive in good condition, the ulcerations have healed, and the glands receded. One is clinically well after fourteen months, the other three after six to eight months. They have gained in weight and to all intents and purposes enjoy good health.

Fifteen cases were treated for metastases subsequent to primary radical excision of the breast. This group comprises 2 cases with metastases in the spine, 2 of the hip, 5 of the opposite breast, 2 of the supraclavicular glands of the opposite side, 3 with mediastinal metastases, and 1 case of metastatic skin nodules. Nearly all of these cases were in an absolutely hopeless condition. Of this group 9 are dead, 6 are still alive, 3 clinically free of the disease at present. In only 2 cases, however, could the radiation be said to have been of no avail.

In connection with this report I wish to mention 8 cases radiated immediately after the operation (prior to the modern intensive treatment) which have remained well from four to nine years. During the same period 14 cases were treated with the old technique for recurrences, all but three have succumbed.

	No. of Cases	Clinically Arrested	Favorably Influenced	Not Influenced	Dead
Pre-operative	15	15	0	0	0
Postoperative	23	21	2 ⁽¹⁾	0	0
Recurrent following operation	12	9	0	1	2
Distant metastases following operation	15	3	0	3	9
Primary inoperable	8	4	2 ⁽²⁾	0	2
Total	73	52	0	4	13

(1)—One case developed metastases in hip, which receded under radiation. Another case developed recurrence in scar, which also receded under radiation.

(2)—Two cases were rendered operable by the intensive radiation, and radical surgical excision was performed.

radiation; the other case developed a small nodule, in the scar, which has since receded.

Twelve patients presented themselves with recurrences either in the scar or axillary or supraclavicular regions, anywhere from three months to eight years after the primary operation. Of this group two have died of multiple metastases elsewhere, one has developed spinal metastases. The other nine are

From this brief clinical report, it is obvious that pre-operative and post-operative radiation, though it has not accomplished a clinical cure in every case, has surely exerted a most beneficial influence upon the outcome of these cases. It is difficult to conceive, moreover, how radiation can be made responsible for postoperative recurrences if no cancer cells were left behind at the time of the radical surgical excision of

the tumor. On the other hand, if in the experience of some surgeons the percentage of postoperative recurrences was enhanced by prophylactic radiation, it would serve to prove that in spite of the most extensive operation, cancer cells were left behind to resume active proliferation, and hasten recurrence. Just in these cases it is paramount to proceed with intensive radiation in the form of a complete carcinoma knock-out dose, in order to destroy the cancer foci in the areas inaccessible to the knife. In other words, this is the very type of case in which recurrence is sure to follow if no radiation is instituted, and if in-

telligent and adequate radiation fails to prevent recurrence, it can be attributed to the presence of cancer cells, which proved resistant to the ray, as well as inaccessible to the knife.

Of course, there is one argument which may be advanced by the adversaries of postoperative radiation, namely, that the cancer cells which were left behind at the time of operation, may be brought to greater activity by radiation, and become stimulated. If this should occur it would be because of an error in radiation dosage. This kind of error in technique is to be guarded against, and strongly condemned, though an error in technique

cannot count as an argument against radiation, any more than an error in surgical technique can count against surgery.

The proper dosage of radiation will destroy cancer cells left behind at the time of operation, and the time has come when the surgeon and the radiotherapist should decide the best means of dealing with a given case of cancer of the breast. It is my impression that the best interests of these cases of carcinoma of the breast have not been served unless they have received the combined aid of the surgeon and radiotherapist.

The Practical Dosage of X-Rays*

ALBERT BACHEM, Ph. D.
Chicago, Illinois

IN the practical dosage of x-rays two questions have to be considered:
1. How can we apply to the skin a known dose of radiation that will produce a certain biological reaction?

2. What is the best way to find the intensity at certain points in the depth in comparison to the intensity on the surface.

Let us consider the first question. This is a very important question for the radiotherapist who is starting x-ray therapy and who intends to apply the proper erythema dose without danger to the patient. It is very interesting to compare the different erythemas given by different physicians, especially as the energy used for the erythema of the skin is generally regarded as the unit for the energy sent into the body. The usual comparisons of the intensity and hardness of the radiations stating the kilovoltage, the milliamperage, the filtration and so on, do not satisfy the requirements of exactness. This may be shown by the following examples:

With 200 kv., 1 mm. Cu, focal skin distance 50 cm. Dr. Schmitz gives as strongest possible erythema 450 ma. min.

With 220 kv., 1 mm. Cu, focal skin distance 50 cm. Dr. Tyler gives 450 ma. min.

With 200 kv., 1 mm. Cu, focal skin distance 50 cm. another clinic gives nearly 800 ma. min.

With 200 kv., $\frac{1}{2}$ mm. Cu, focal skin distance 50 cm. Dr. Smith gives 500 ma. min.

In the last case a shorter time of application ought to be expected, as with

the lower filtration the intensity should be larger and the rays should be softer. How may one avoid such discrepancies?

If we want to answer these questions and to make physical measurements, the following difficulty arises: The relation between the intensity, measured by physical instruments and the biological effect changes with the hardness of the rays. For instance, the amount of energy which produces a certain erythema, measured as F-units with the Fuerstenau Intensimeter is about 70 F with soft rays, with hard rays about 400 F; in a similar manner when using the Kienboeck strips the amount of 10 x-units has to be applied for soft rays and about 40 x-units for hard rays. With these old methods of measuring the intensity, the hardness cannot be determined exactly and is usually expressed by the kind of filtration used. Therefore, it is not known at all which amount of F or X is necessary for an erythema.

To overcome these difficulties two methods have been applied. One method originates with Professor Friedrich in Freiburg. His intention is to reduce the error of the hardness to a minimum by using small chambers of different materials, different sizes, and different thicknesses of the walls in his experiments, and thus eliminate this error within a certain range of rays. With the usual instruments, the ionization chambers (also used here in America), the error is not totally eliminated. This was proved by measurements, which I made in the Chicago Institute of Radiation Therapy, with one American apparatus and two German ones.

If we know the time of discharge, measured in seconds, we have to multi-

ply this time by a certain factor in order to calculate the time necessary for an erythema skin dose. This factor is not constant, but varies according to the hardness of the rays. For example (Table I), with 130 kv. and 0.5 mm. Cu the time measured with our own iontoquantimeter has to be multiplied by 3 in order to give the number of minutes that produce the Schmitz erythema skin dose. In working with 200 kv. and 1 mm. Cu we have to multiply by 4 in order to produce the same erythema. With another iontoquantimeter, which was standardized by us biologically, the factors were 4.6; 5.0; 5.3 for different hardnesses. With an American instrument containing a small paper chamber the factors were 1.8; 1.7; 1.6, which means that the error is reversed. Unfortunately, it is not possible to determine the hardness of the rays with the iontoquantimeter independently of other factors, such as the focal skin-distance, size of the field and so on. These factors may vary with the different investigators.

In order to compare the intensities and hardnesses of different transformers I have constructed a transportable electroscope (Fig. 13) which works so constantly that all measurements can be compared. The only movable part of this instrument is an aluminum leaf which is deflected by the electric charge. This instrument will soon be standardized in "e" units so that it can deliver also absolute physical values. The electroscope was standardized by the different machines which Dr. Schmitz uses, on the basis of different known skin erythemas, characterized by epilation, so that the erythema factor for all hardnesses is known as exactly as biological observations permit it. The

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May 20, 1922.

curve in Figure 1 shows how the factor depends upon the hardness. The hardness is defined exactly by the total absorption factor μ . The comparative measurements of different hard rays were made in Bonn. By these investigations it is possible to compare the energies of erythema that have been given by different authors with different hard rays. The different sizes of the fields are not considered in these measurements, though they give different results. If we consider these factors the result would be that the erythema dose which was applied in Bonn is 1.7 times as large as the unit dose of Seitz and Wintz, and that the dose of Warnekros and of Borell is still 1.4 times larger than the first dose. Such measurements would be of great importance in relation to the different biological effects. The main importance of the double measurements of intensity and hardness which can be obtained with the electroscope

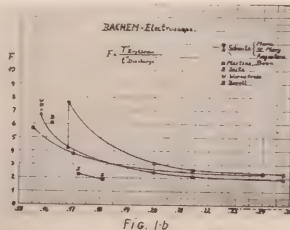
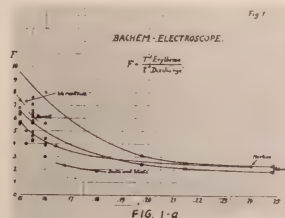
is the fact that the erythema time can be predetermined for every hardness.

For the determination of the x-ray intensity in the depth I could demonstrate two methods. I should like to differentiate them as the direct and the indirect method.

The direct method consists in determining the depth dose with the iontoquantimeter under the same conditions as obtained during treatment, namely, with a known kilovoltage, milliamperage, filtration, focal skin distance and port of entry. This can be done on the patient or with a water phantom. Of course, the depth dose will only be known at certain points, generally in the depth of 5, 10 and 15 centimeters. The calculation in other depths of the central beam can then be made by using the law of squares and the exponential law of absorption. The best method would be to put down these results in a system of curves and to use

them according to the focal skin distance and the deep quotient in question. In the following figures the curves are drawn for different deep quotients (30, 40, 50 per cent), as calculated and measured by different methods. Figure 2 shows curves for deep quotients from 30 to 60 per cent, which are drawn exactly according to the exponential law of absorption. These curves can be calculated and drawn very quickly but they neglect the law of the square of the distance. If we regard this law for 30 and 50 cm. focal skin distance, we get the curves in Figures 3 and 4. This calculation shows, that even by the hardest rays no higher deep quotients than 54 and 69 per cent are possible. The dotted curves correspond exactly to the law of the square.

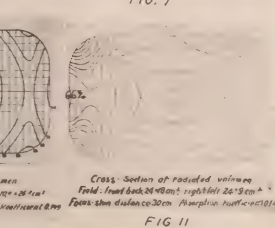
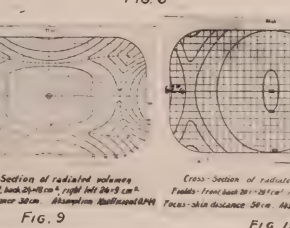
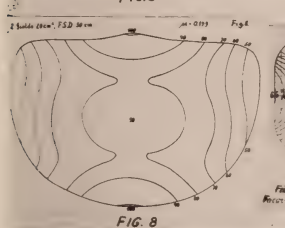
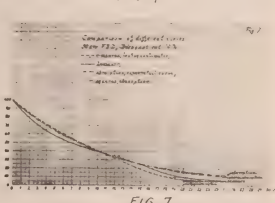
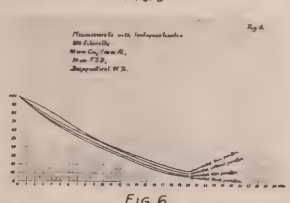
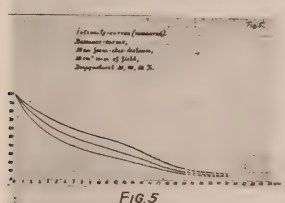
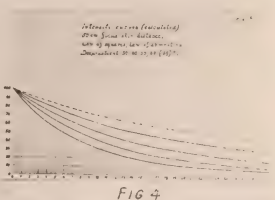
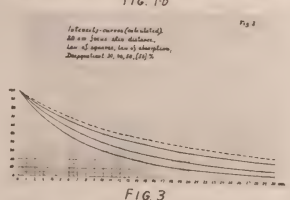
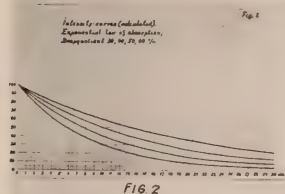
Besides these calculated curves I should like to show you curves which are obtained by measurements. Using the different Dessauer charts at 50 cm.



Erythema-Factors.

KV	Filter	Erythema Time	Factor I	Factor E	Factor H	Factor P
200	1.00	35'	9.0	5.3	2.6	5.7
175	0.75	71'	3.7	5.0	1.7	9.0
150	0.50	120'	3.0	4.6	1.9	2.7

TABLE 1



focal skin distance and large fields and different hardnesses, we can draw the following curves for 30, 40 and 50 per cent deep quotient (Fig. 5). They differ very much from the former ones. Generally the result is a better one in so far as at the center a greater intensity is to be found, and at the end the intensity decreases rapidly. That is produced by scattered radiation, which is especially active in the interior of a large radiation cone. Similar curves can be obtained by measurements with the iontoquantimeter. Of course, the measurements have to be exact. On the surface of the water phantom we have to place a layer of paraffin of half the thickness of the diameter chamber; if we measure in the deep, a layer of paraffin of the thickness of the chamber must be used. Further, we have to consider the undesired radiation. Correcting the latter we get a deep quotient somewhat smaller than without correction. As the time is too short I cannot

talk about the different stages of the exact measurements. The results of the different measurements are shown in Figure 6. The curve obtained by not using the paraffin on the surface looks and really is wrong. The other curves differ only by the value of the deep quotient. In the center they all run nearly straight and at the end they have very small values, nearly the same as those of the Dessauer charts. It is very interesting to compare the different curves for the deep quotient of 40 per cent. All curves show characteristic differences. The measured curves coincide at least two points in the depth. After having determined in this manner with sufficient exactness the distribution of the intensity along the central beam we are enabled to combine two radiation cones, for instance, an anterior and a posterior one. We can calculate what intensity is given in the deep and we can find what intensity is sent through the body by each field.

For instance, with a patient of 20 cm. diameter, and using a certain radiation, 10 per cent reach the opposite side of the body. In order to produce the same erythema, as with one field, the time has to be reduced, so that instead of 110 per cent only 100 per cent strike the skin. Then the full amount of the two deep quotients does not reach the depth, but only the percentage which is reduced in the same ratio. It follows that with two fields 100 per cent can never be sent into the depth, as is so often incorrectly claimed. Therefore if we want to produce a large effect in the depth two possibilities are given:

1. A very strong erythema must be given, so that less than 100 per cent, about 80 or 85, would be sufficient to destroy the cancerous tissue.

2. More than two fields, four fields for instance, can be given. Then the focal skin distance may be shortened to 30 or 40 cm., and again the time of each application has to be reduced, so that the skin may not be injured by the full amount. Radium may be used in both cases also.

However, the addition of four fields is impossible, if only the intensities of the central beam are known. The distribution on the periphery and without the fields must be known. It is scarcely possible, by our own measurements, to measure the distribution of the intensity in all the radiated and not directly radiated areas by the direct method. Such measurements have been made with very great exactness and completeness in the Institute for the Physical Foundations of Medicine in Frankfurt on the Main. The results have been published in the Dessauer charts. These charts consider all possibilities such as different focal skin distances, different sizes of the fields, and different hardnesses. If both geometrical facts are given, for example 50 cm. focal skin distance, 20 cm. port of entry, the hardness has to be known also, either as the total absorption coefficient μ , or as the deep quotient. Then we know what charts have to be used. Knowledge of the kilovoltage is not sufficient, as I have demonstrated before. In Germany the kilovoltage is measured very differently, therefore quite great differences arise. The best way is either to measure the deep quotient by a correct iontoquantimeter under well known conditions and to select the Dessauer charts with these values, or to measure the μ by an electroscope.

Using the Dessauer charts we are able to find the distribution in the depth, even if we combine three or four fields for every desired point in the interior and on the surface. Some examples

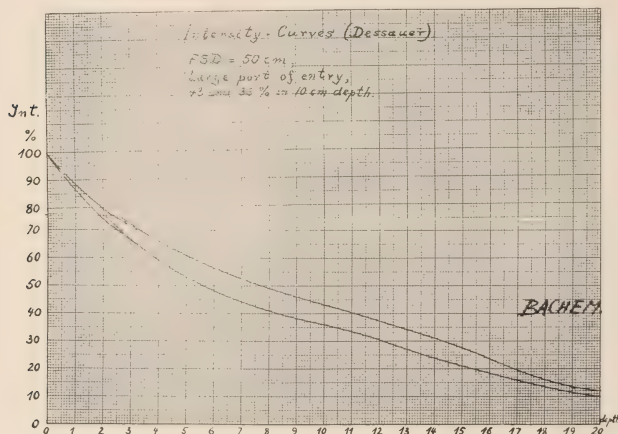


Fig. 12

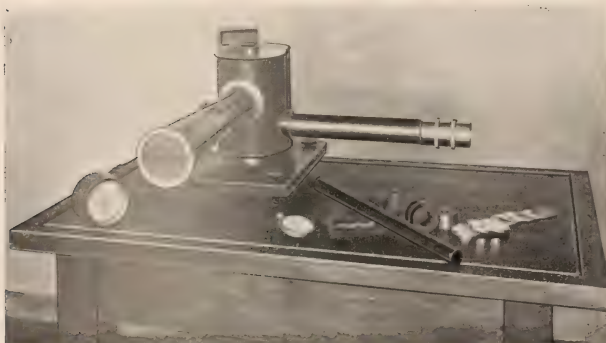


Fig. 13

may show you the results of different methods of treatment (Figs. 8-11).

By such figures and by special investigations we can find what are the best and most economic conditions for practical treatment and what amount of radiation in each case is sent to each point. The last method, to define and to find the necessary three factors, and then to use the given exact measure-

ments may be called the indirect method.

You see, gentlemen, how it is possible today to give a correct dosage. What I have explained to you in this short paper is not a certain method that I would like to recommend to you—it is very indifferent which method you use.

The chief factors are to give an exact physical skin dose, a dose which

always remains the same, or which is always known, and to know the intensity, which is given at important points in the depth. Only when the physical dosage is given correctly in this manner is the comparison with the biological result possible. Then only is a real scientific investigation of the biological effects of x-rays possible and then only does it promise to be successful.

ULTRA VIOLET RADIATION

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PHYSIOCHEMICAL reactions, particularly those induced through the influence of radiant energy displayed on biologic structures, must be interpreted in terms of electronic behavior. Speaking generally, it is correct to assume that the physiological effects of ultraviolet energy have their origin in the photochemical reactions produced when the energy is absorbed. In the case of simple organic compounds *in vitro*, ultraviolet radiation, depending upon its constituent wavelength, acts as a powerful oxidizing and reducing agent; and so we may suppose that with the more complex chemical compounds whose totality represents the living cell, the same is true.

Thus, obviously, whatever are the therapeutic benefits derived from the use of ultraviolet radiation they are qualities governed by the characteristic absorption of the energy ⁽¹⁾ as expressed by the photochemical law of von Grotthus, that "Only the radiation that is absorbed can effect chemical change." It must be observed that while we may know much on the topic of ultraviolet absorption by tissues, this does not at all explain how the radiation is successful in bringing about clinically established improvement and remedy of diseased states. But we do gain a clearer insight into certain fundamentals that, though they fail to explain some empiricisms, indicate definitely the avenues of scientific approach for future research and investigation.

When ultraviolet radiation strikes a tissue surface, as for example, skin, one part is absorbed, another is reflected, a third is transmitted. Assuming the original intensity of the incident ray to be I, and A, R and D to represent, respectively, the amount absorbed, reflected and transmitted, then,

$$I = A + R + D$$

As we have seen in the study of the cosine law, the incident intensity of ultraviolet is greatest when the ray strikes the surface at a right angle. In

proportion as the incident ray assumes a direction less than 90 degrees, the amount reflected is greater and greater. This loss by reflection is an important clinical consideration and may be compensated by suitable increase of the exposure time, about as follows:

At an incident ray angle of surface treated.	Compare with exposure time, at fractional increase required
90°	0
75°	1/10
60°	1/5
50°	1/4
45°	2/5
30°	1/2

That is to say, an exposure that will produce a given erythemic reaction in sixty seconds with tangential illumination, will require, to produce the same degree of erythema when the incident central ray is oblique:

Incident Angle	Time, Seconds	Compensatory Increment	Total time, Seconds
90°	60	0	60
75°	60	1/10	6 66
60°	60	1/5	12 72
50°	60	1/4	15 75
45°	60	2/5	24 84
30°	60	1/2	30 90

The amount of light reflected by a surface on direct illumination was designated by Lambert as albedo; and we may similarly introduce the term actinic albedo for the increased reflection coming from oblique illumination. For the angles given, therefore, the fractions represent "actinic-albedo corrections."

When the maximum absorption of ultraviolet energy is assured by minimizing the reflected portion through tangential radiation, or through extended radiation time measured according to the actinic-albedo constant, we are next concerned with the changes assumed by the absorbed energy.

Very broadly, the shorter the ultraviolet wave lengths, the greater the absorption by any given medium. Studying the penetration in microns for skin irradiated with ultraviolet, we find a rather even decrement in micron pene-

tration as the wave lengths become shorter; but when a certain limit is reached, the relation between shortness of wave length and extent of penetration no longer obtains. This is exemplified in Figure 1. Observe that the skin penetration becomes proportionately less as the wave lengths of ultraviolet become shorter; and that in the region of 2,900 Aengstrom units, the penetration is indeed slight and varies little with subsequent shortening of the wave length. We may speak of this phenomenon, which is characteristically shared by all tissues, as the "extinction coefficient;" and we find that each tissue and protoplasmic unit has its characteristic extinction coefficient, which, for skin, is 2,900 Aengstrom units.

It is significant to observe that the extinction coefficient for skin is located in the ultraviolet region representing the extreme limit of the ultraviolet spectrum reaching us from the sun. This is a critical point; for the action on the human economy derived from wave lengths shorter than the extinction coefficient limit can no longer be due to anything other than barest superficial activity. Expressed biophysically, ultraviolet radiation of wave lengths larger than about 2,900 Aengstrom units attacks atomic and molecular vibrations; and wave lengths shorter than 2,900, attack electronic vibrations (photo-electric effects). These differences reveal themselves therapeutically, and have led to the modern concept of ultraviolet usage in which the near ultraviolet region is considered biotic, the far ultraviolet region abiotic ⁽²⁾ in action.

Recently, from the work initiated by Koeler and later elaborated upon by Barnard, it has been shown that certain cell structures absorb greater quantities of ultraviolet energy than others; and that if unstained tissues are examined under a quartz lens microscope "illuminated" with ultraviolet, the struc-

tures that absorb most of the energy are more opaque than those absorbing less. Since a photographic emulsion is sensitive to ultraviolet radiation, this difference in the absorptive capacity of various structures of the cell is beautifully revealed. Bayliss, in his "Principles of General Physiology," gives the accompanying illustration, which is self-explanatory (Fig. 2).

It will be noted especially that the nuclear or "chromaffin" structures of cells are particularly affected by biotic ultraviolet radiation; which leads to this premise:

Imagine two cells 80 microns in diameter with centrally placed nuclei. Suppose a ray of biotic ultraviolet energy ⁽³⁾ strikes the first cell tangential to its surface; and a ray of abiotic ⁽⁴⁾ ultraviolet radiation similarly strikes the second cell. In the first case, the long ultraviolet wave lengths reach the nucleus and accelerate its activity. In the second case, only the ectoplasm of the cell is reached, where coagulative changes (Bovie) are induced, so that even the normal products of cellular activity can no longer pass through the cell wall, which alone has been modified. A sketch (Fig. 3) will make this clear.

If instead of a single cell we imagine a number of layers of cells 80 microns deep, obviously the effect is intensified. So that long ultraviolet radiation displays a maximum effect on the nuclear or chromaffin structures, accelerating their function, and therefore inducing such physiologic reactions as may depend upon increased chromaffin activity. Short ultraviolet wave lengths, by attacking the limiting membrane of the cell and thereby changing its osmotic proportions, provoke physiologic reactions in which the virtual elimination of nuclear function is characterized. This has been summarized in the expression that long ultraviolet wave lengths are metabolic stimulators, and short ultraviolet wave lengths are metabolic depressors. Or, nuclear physiology may be increased or eliminated, depending upon whether long or short ultraviolet wave lengths are used. Since the oxidizing and reducing qualities of cellular action are centered in the biochemistry of the nucleus the basis for classifying the energy into "oxidizing" for long wave lengths and "reducing" for short wave lengths, is again revealed.

Metabolism represents a reaction between a force and a resistance. The force, dominantly chemical in origin, is derived from two sources, which are:

1. Intrinsic.
2. Extrinsic.

Intrinsic sources include the breaking down (katabolism) and building

up (anabolism) of foodstuffs ingested for the upkeep of the economy.

Extrinsic forces include the climatologic influences of the environment in which the living structure is immersed, for example, air and radiant energy supplied as visible energy (light) and invisible energy (infra-red and ultraviolet rays).

All the laws regulating the operation of these intrinsically and extrinsically derived forces are entirely subject to the fundamental principles of energetics; from the study of which we may conclude that the breaking down and building up processes involve three factors, namely, a chemical force, a chemical resistance, and a chemical velocity. Metabolism being in this manner reduced to a chemical mathematical expression, we find that it involves:

- (1) F_c = Chemical Force.
- (2) R_c = Chemical Resistance.
- (3) V_c = Chemical Velocity.

so interdependent as to bear the following relation one to another;

$$(a) \quad V_c = \frac{F_c}{R_c}$$

From which,

$$(b) \quad F_c = V_c \times R_c$$

That is, the inherent chemical force operating in a given instance is the product of the velocity of chemical reaction times the chemical resistance. Those entities in which metabolism is below par are expressions of diminished chemical force or increased chemical resistance. Those cases in which the metabolic rate is above normal are an expression of an enlivened chemical force or accelerated velocity of reaction.

Considering the entire epidermal integument of an individual as an organ contributing liberally to the metabolic integrity, it is at once obvious what may be expected when the environment

is suddenly changed chemically, or, what amounts to the same thing, when the organism is subjected to a flood of ultraviolet radiation. Such terms as "constructive energy," "chemical energy," used synonymously with ultraviolet energy, show the heretofore empiric endeavor to describe the peculiar effect of ultraviolet radiation on the regulation of metabolism. Viewed in the light of the energetic theory propounded, it is interesting to observe how an increase in any of the factors (F_c , V_c and R_c) involved in metabolism may influence the trend of metabolic balance in the individual. In the equation

$$F_c = V_c \times R_c$$

Suppose that there be assigned arbitrary values, as follows:

$$\begin{aligned} F_c &= 8 \\ V_c &= 4 \quad \text{or} \quad F_c = V_c \times R_c \\ R_c &= 2 \quad \quad \quad 8 = 4 \times 2 \end{aligned}$$

This, it will be assumed, represents the division of energetics, or the metabolic state of an hypothetical case. Under the long wave lengths of ultraviolet radiation, the chemically active fraction (nuclei) of many cells is increased; which is the equivalent of saying that the chemical force is augmented. If the chemical force is doubled, there must be corresponding changes in either the chemical velocity or the chemical resistance to satisfy the equation; or, under long wave length ultraviolet radiation, if instead of F_c being equal to 8 units, $F_c = 16$ (or 8 doubled) then,

$$\begin{aligned} F_c &= V_c \times R_c \\ 16 &= 4 \times 2 \end{aligned}$$

Supposing instead that short or abiotic ultraviolet wave lengths are used. By their ectoplasmic coagulation they eliminate the contribution to metabolic function by isolating the products of nuclear activity. The increase in chemical force operating on the ecto-

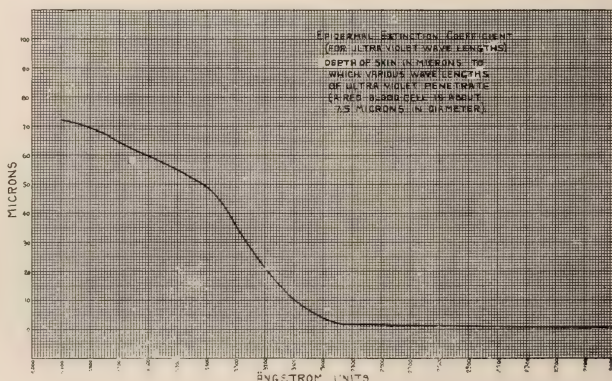


Fig. 1

plasm, mostly, changes the velocity of reaction by increasing chemical resistance; when,
 $Fc = Vc \times Rc$ then $16 = 2 \times 8$
 Metabolism (in certain of its phases) is an expression of the chemical forces operating with speed against a resistance. Near ultraviolet increases the speed; far ultraviolet increases the resistance. Or, in the language of the clinic, near ultraviolet energy is a metabolic accelerator and far ultraviolet energy is a metabolic depressor. Of course, there are many additional factors that must be considered in connection with the action of ultraviolet, as, for instance, the effect upon the enzyme content of cells. But these are not immediate problems in absorption and must, therefore, be relegated to subsequent presentation.

Beside reaching depths of 70 or more microns in cellular structure, the near ultraviolet radiation meets also, in its passage through the cell layers, capillary blood and lymph. Both are strong ultraviolet absorbers, as Finsen originally demonstrated. But their response to ultraviolet energy is only indefinitely known.

Speaking first of the blood, there may be considered:

- (a) Red blood cells.
- (b) White blood cells.
- (c) Plasma.

The plasma is conceived as a colloidal solution of proteins and salts in which ultraviolet absorption depends upon five factors:

- (1) Chemical nature of dispersion phase.
- (2) Concentration.
- (3) Degree of dispersion.
- (4) Particulate content.
- (5) Structure and character of con-

tained particulate surfaces.

These many and complicated factors governing the absorption make the complete appraisal of the biophysics involved a most intricate group of problems, few of which have yet been solved. For example, Tadokoro investigated the antagonistic action of salt in blood serum; and he found that the ultraviolet absorption may be influenced by the reversing action of the serum dispersion which comes from the simultaneous presence in the serum of two salts. Together with Nakayama, Tadokoro found also that as the serum concentration decreased, its transparency to ultraviolet increased. They showed also that an immune serum holds from two to ten times greater absorption limits in the ultraviolet region, as does a normal or non-immune serum.

This increase in the limits of ultraviolet wave length absorption in the serum is observed as a result of repeated bodily irradiations, and expresses, probably, what clinicians report when they speak of the "general raising of immunity" incident to systemic actinic radiations.

Hemoglobin absorption spectra are well known from their constant reappearance in general physiology treatises. As hemoglobin undergoes changes under the functional activity of respiration, it changes to various loosely combined products, of which we may mention oxyhemoglobin and carbon dioxide hemoglobin. There has been found a shift of the limit of ultraviolet absorption, and visible light absorption, which plays a peculiar role in the physiology of respiration, as follows: Changed hemoglobin absorbs a greater limit of ultraviolet and visible light than un-

changed hemoglobin. The limit is extended by a shift which includes longer wave lengths. From which it appears that as soon as hemoglobin suffers whatever chemical change (oxyhemoglobin, methemoglobin, reduced hemoglobin, carbon dioxide hemoglobin, etc.) incident to the transportation of oxygen from the lungs to the tissues, or back from the tissue to the lungs, this incites an ability on the part of the changed hemoglobin to become responsive to an increased range in the ultraviolet spectrum and some parts of the visible spectrum. By this increase, a greater chemical force is exerted in the blood pigment which leads to the dissociation of the hemoglobin and therefore prepares it for the renewed dispatch of its oxygen carrying capacity.

It must not be assumed, as some have contended, that ultraviolet energy is absorbed by the blood, and as such, is conveyed for distribution to various parts of the body where it may be again emitted. This concept is implied in the following experiment, somewhere recorded: "One of these films (a dental x-ray film is meant) was placed upon the back of the thigh in the dark room and covered with black photographer's paper of several thicknesses and strapped on with adhesive straps covering the edges of the paper and the surrounding skin as well. There was obtained a distinct fogging of the film after an exposure of three minutes to a mercury vapor lamp held in front of the leg opposite the film. To see if this was the result of straight penetration or of secondary radiation from the blood stream, another film was fastened in the same place and the opposite shoulder exposed to ultraviolet with the film and rest of the body carefully protected from the ray. The same fogging resulted."⁽⁵⁾ Even a superficial knowledge of the physics of ultraviolet radiation is sufficient completely to refute the validity of statements such as the one just quoted. Visible light, some regions of which affect an x-ray film, can pass through various thicknesses of tissue measured in inches. Ultraviolet radiation is, of course, quickly absorbed in depths that approximate one-thirtieth of one inch; and when waves are absorbed their identity as a wave motion is entirely lost, the impact of the wave motion on the absorbing medium inducing certain biophysical changes. The products of the biophysically induced changes may be carried around in the circulatory stream; but this is radically different from the thought conveyed in the quotation.

In view of the difficulty that attaches itself to the problem of ultraviolet absorption, a correct understanding of

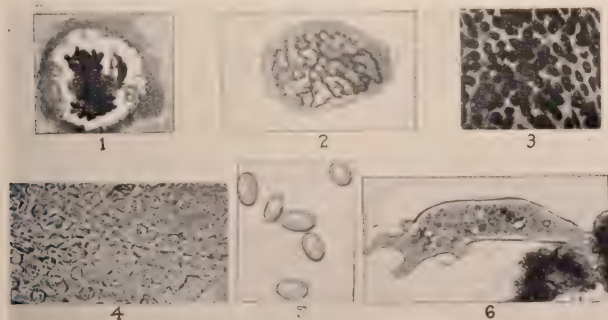


Fig. 2—Nos. 1 and 2—Dividing nuclei from gill plate of salamander larva. Unstained, in glycerol. Photographed with ultraviolet light of 280 μ . The chromatic substance appears as if stained. No. 3—Edge of sternal cartilage of newt. Living. Photographed with ultraviolet light. The nuclei are opaque. No. 4—The same photographed with ordinary light. The nuclei are transparent. No. 5—Red blood corpuscles of the newt. Living. Photographed with ordinary light; although oblique illumination was used the nuclei are almost invisible. Traces of diffraction are seen around the corpuscles. No. 6—*Ambystoma*. Living. Photographed with ordinary light; the nucleus is just visible, but transparent. (Nos. 1 to 3 after Koeler.)

which will make intelligible the therapeutic applicability of the energy it becomes necessary that there should be presented the more recent summary of the physics of ultraviolet absorption.

When a ray of ultraviolet radiation traverses an absorbing substance, a certain proportion is absorbed. The proportion is independent of the *original* intensity; the amount absorbed is proportional only to the *incident* intensity. Also, the amount absorbed is the quantity represented by the equation:

$$A = \frac{I_0 - I}{I_0}$$

Where A = amount absorbed;

I_0 = incident intensity;

I = amount transmitted.

Or, in another form, the transparency constant of a substance may be expressed as:

$$\frac{I}{I_0} = T$$

Where T is the transparency. Now, it follows that in a homogeneous medium, and with monochromatic light, if the thickness increases in algebraical proportion, the light transmitted decreases in geometrical progression. Suppose I be the intensity of a small layer traversed by ultraviolet, d c, then—

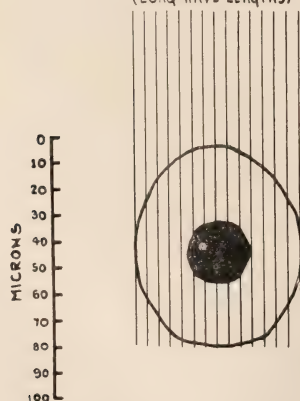
$$\frac{d I}{d c} = K I$$

On integration, this gives, when I_0 is the original intensity and d the total thickness—

$$I = I_0 e^{-k d}$$

the constant depending upon the nature

AIR COOLED NEAR ULTRA VIOLET
(LONG WAVE LENGTHS)



DIAGRAMMATIC REPRESENTATION OF THE CELL STRUCTURE ATTACKED BY LONG AND SHORT ULTRA VIOLET WAVE LENGTHS. IN THE FIRST CASE, THE NUCLEUS IS ATTACKED. IN THE SECOND, THE ECTOPLASTIC MARGIN. BASED ON THE EXTINCTION COEFFICIENT STUDIES (PENETRATION IN MICRONS) FOR SKIN. PACINI.

of the substance and the wave length of the ultraviolet energy.

BEER'S LAW

It was deduced by Beer that absorption is the same function of the concentration of a dispersed absorbing substance as of the thickness of a single substance. The material upon which this law was propounded is rather inadequate; the law having in some instances been confirmed, in others not. In the case of solutions, the situation is about as follows: Solutions may be molecular dispersoids or lower degree dispersoids, being in the first case true solutions, in the latter, colloidal solutions (Ostwald). Differences in concentration of the solution should not affect the condition of the dispersed substance in order that the law might be valid; and this situation, in the case of biologic fluids, does not at all obtain. In solutions, the absorption is influenced by a number of factors, as for instance,

1. Changing concentration of the solvent (blood stream before or after a meal).

2. Influence of temperature (as in febrile pathology or physiologically induced heat changes through diathermy).

Not only does the concentration of the blood stream, as influenced by its water content in the ascites incident to cardiac insufficiency, and the chyle content after digestion, affect the absorption of ultraviolet because of the colloidal constituency of the serum, but the products carried to and from the tissues in the course of metabolism exchange are also photosensitive.

WATER COOLED FAR ULTRA VIOLET
(SHORT WAVE LENGTHS)



Amino-acids behave peculiarly toward ultraviolet energy, as Soret, Kober and Harris and Hoyt have shown. Speaking generally, these observers find that the ultraviolet wave lengths not absorbed by tyrosine and phenylalanine are relatively non-toxic for protoplasm; which means that the toxic, or abiotic region, lies between the limits of 2800-2400 Aengstrom units.

That the ingestion of certain protein foods is followed by marked hypersensitiveness to light is an established observation. Eggs, maize, and buckwheat are best known examples. An examination of the amino-acid composition of the proteins of these foods ⁽⁶⁾ shows them to contain high percentages of phenylalanine and tyrosine as compared to proteins obtained from other foods; and this may explain the factors involved in the mechanism that occasions photosensitization.

Enough has been given to show how intricately complex is the absorption of ultraviolet energy in tissues, from which studies we may reach tentative conclusions, as follows:

1. That long ultraviolet wave lengths are molecular and atomic in their attack, influencing especially the nuclei of the cells they reach.

2. That short ultraviolet wave lengths are electronic in their effect, striking particularly the ectoplasm where they occasion coagulative changes that make the cell more impermeable to osmosis.

3. That through these actions, the one derived mainly from air cooled lamps, the other from water cooled lamps, the regulation of metabolic pace is had according to the equation—

$$F_c = V_c \times R_c$$

4. That the biotic effects of the long ultraviolet radiation depend upon the complicated phenomenon of absorption, involving—

- Cytoplasm.
- Nucleus.
- Blood (capillary).
- Lymph.

5. That the *original* intensity of the lamp is not the measure of clinical efficiency, but this measure is the incident intensity, as modified by the cosine law.

For substances other than tissues, the regional transparency to ultraviolet should be known, as their use for selective filtration might be desired. Luckiesch gives the following table:

Natural blue rock salt . . . beyond 2250
Natural rock salt colored by
cathode rays beyond 2250
Natural rock salt colored blue by
cathode rays beyond 2250
Sylvite, white beyond 2250

Chili saltpetre, ordinary white variety	3512
Chili saltpetre, violet	3248
Fluorspar, colored deep violet by cathode rays	beyond 2250
Diamond yellow	3200
Diamond blue	3150
Kunzite	3050
Garnet	4023
Zircon (hyacinth) red brown	2618
Zircon, decolorized by heat	2442
Zircon, green	4023
Zircon, yellow	4023
Topaz, pale yellow	2618
Topaz, dark yellow	2294
Topaz, pale pink-brown	2618
Topaz, blue	2961
Emerald	3200
Ruby	3000

Tourmaline, green	beyond 3512
Tourmaline, green-yellow	3000
Tourmaline, pink	3064
Spinel, blue	4023
Spinel, purple	3248
Spinel, pink	3000

For the transmission characteristics of various special glasses used as ultraviolet filters, the Corning Glass Works, Corning, N. Y., and the firm of Schott and Genossen in Jena furnish detailed information.

Having in the first of this series presented the factors in the generation of ultraviolet energy; in the second, its modification incident to the conditions under which it is used; and here, some of the principles involved in its absorption, we are better prepared to

understand how ultraviolet energy operates in pathology, and to this understanding the studies subsequently presented will be directed.

FOOTNOTES

1. Any discussion of "ozone" inhalation and psychic influence claimed as a part of ultraviolet ray usage is entirely beyond the province of biophysical assay, and is even of questionable clinical efficacy.

2. Bactericidal action is abiotic.

3. Air cooled lamp.

4. Water cooled lamp.

5. American Journal of Electrotherapeutics and Radiology, p. 434, December, 1920.

6. Sherman's "Chemistry of Food and Nutrition."



EDITORIAL

The JOURNAL OF RADIOLOGY

A Journal of ideas and ideals.

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ANNUAL MEETING

Hotel Statler, Detroit, Michigan

December 4, 5, 6, 7, 8, 1922

The December Meeting

THE FOLLOWING PAPERS have already been arranged for the annual meeting of the Radiological Society, which will be held at the Hotel Statler, Detroit, Michigan, December 4th to 8th, inclusive. There will be many more papers by prominent men throughout the United States and Canada. This list was on hand the first of October when the Journal went to press.

Judging from the correspondence which is being received relative to the meeting, there will be the largest attendance which the society has ever had. Having this in mind, it is suggested that those who expect to attend would do well to make hotel reservation at once.

CARL C. BIRKELO, M. D., Detroit, Mich.—Case Reports:

- (1) Calcification of the Kidney with no History of Tuberculosis.
- (2) Calcification of the Visceral Pleura.
- (3) An Extensive Atrophic Arthritis in Both Feet.
- (4) Bilateral Calculi in the Fallopian Tubes.
- (5) Congenital Dislocation of the Hip Joint with Large Exostosis of the Neck of the Femur Extending Into the Acetabulum.

ALBERT BACHEM, PH. D., Chicago, Ill.—Comparison of Measurements of Intensity and Hardness of X-rays Produced by Different Types of American Transformers.

KURT H. THOMA, D. M. D., Boston, Mass.—Roentgen Diagnosis of Lesions of the Maxillary Bones.

JOHN R. CAULK, M. D., St. Louis, Mo.—The Relationship of Roentgenology to Urology.

C. G. SUTHERLAND, M. D., Rochester, Minn.—Radiography in the Examination of the Urinary Tract.

JAMES S. PRITCHARD, M. D., Battle Creek, Mich.—The Importance of Oblique Films in the Study of the Thorax.

WM. L. ROSS, M. D., Omaha, Neb.—The Therapeutic Uses of X-rays Other Than on Malignant Growths.

L. R. SANTE, M. D., St. Louis, Mo.—Lung Abscesses.

WM. ENGLEBACH, M. D., St. Louis, Mo.—Radiological Signs of Endocrine Disease.

E. H. SKINNER, M. D., Kansas City, Mo.—Roentgen Analysis of the Right Diaphragm in Health and Disease.

PAUL EISEN, M. D., Detroit, Mich.—Duodenal Regurgitation.

A. U. DESJARDINS, M. D., Rochester, Minn.—Mediastinal Lymphosarcoma and Hodgkin's Disease.

H. T. PLANK, M. D., Chicago, Ill.—Report of an Unusually Interesting Case.

E. H. KESSLER, M. D., St. Louis, Mo.—Diaphragmatic Hernia.

KENNON DUNHAM, M. D., Cincinnati, Ohio—Clinical and X-ray Findings in the Chests of Normal Children.

MARY ELIZABETH HANKS, M. D.—Remedial Effects of X-ray in a Gynecological Case.

WM. J. CASSIDY, M. D., Detroit, Mich.—The Importance and Necessity of Minimizing Diagnostic Errors by Repeated Roentgen Examinations.

W. D. COOLIDGE, PH. D., Schenectady, N. Y.—The Operation of High Voltage X-ray Tubes.

R. D. CARMAN, M. D., Rochester, Minn.—The Roentgenologic Signs of Cancer of the Colon.

P. M. HICKEY, M. D., Detroit, Mich.—Infections of the Sacro-iliac Joint.

R. B. WILSEY, PH. D., Research Laboratory, Eastman Kodak Co., Rochester, N. Y.—The Design of Potter-Bucky Diaphragm Grids.

W. E. HART, M. D., Decatur, Ill.—Congenital Partial Giant Growth.

ISAAC GERBER, M. D., and F. NOLTON BIGELOW, M. D., Providence, R. I.—Further Observations on the Use of the X-ray in Mastoid Diagnosis.

AMEDEE GRANGER, M. D., New Orleans, La.—A New Technique for the Positive Identification of the Sphenoid Sinus and the Ethmoid Cells.

The Profession and The Public

IT REQUIRES neither stretch of imagination nor particular prescience, if one gives any thought to the question at all, to observe that there is a fundamental readjustment taking place in the relation of the medical profession to the public. Or stated perhaps more accurately, the public is forcing a different scheme of medical practice, hoping thereby to achieve more efficient and less expensive application of medical science.

For this reason it may prove of some advantage to attempt a visualization of this transformation—a transformation that is at once expressed by a comparison of the status of the old family doctor, whose memory is still distinct, with that of the highly specialized medical profession of the present day.

Starting from the proposition that the old family doctor covered every phase of medicine and surgery in his practice, and that today there are no less than twenty-five specialties, it may be possible, as well as profitable, to make some deductions from the comparison about to be undertaken, which will indicate at least a logical method by which the medical profession can accomplish the obligation which is impressed upon it as a factor in the social organism.

Not infrequently members of the medical profession make the declaration that the profession is neither the guardian of the public purse nor the custodian of public welfare. But such a position is untenable, in so far as the question of

health affects the earning power of the individuals constituting the public, and in so far as knowledge of causative factors of disease makes for greater health and happiness.

The family physician of yesteryear—the man of empty purse and overflowing heart—occupied a position which may well be described as family confidante. He stood on equal footing with the minister or priest, and to him each member of the family brought his or her intimacies and asked for advice. The family physician listened to the hopes and fears of the woman whose heart fluttered at the prospect of the first born; was present when the child came into the world, gave instructions about its care and feeding; attended it through the whole gamut of children's diseases from tummy-ache to diphtheria and back again; acted as the child's mentor in pubescence and adolescence; counseled it as it grew into young manhood or womanhood, and during courtship and marriage; and he attended that same individual in his or her last illness. For by the grace of the great gift which was in him the true family doctor was never permitted to admit exhaustion or failure, and, according to legend, possessed as he was of the key to the mystery of life, he never died until such time as he willed.

The point in all this is, that the family physician, as our forebears knew him, was their spiritual as well as physical and mental guardian. He was the sorcerer for whom men, women and children called when they fell in love, when they married, and when they died.

Once the family physician had become established in a community, he continued in that community as the friend of each family within its borders. So strong was the confidential bond between physician and patient that a new physician could not compete with him and could only acquire a footing in the community through the sanction of the family doctor. The frock coat, the long flowing beard, the silk hat, and the old kit complete the picture. The relation was so personal that to mention a fee was considered a sacrilege. The result was that the family physician died poor in worldly wealth but rich in clientele.

The practice of medicine today is very different. Now the patient consults a physician in much the same way in which he enters a department store as a customer. He chooses his doctor because of results obtained in some particular case about which he has heard, and lays his trouble before that physician in a businesslike manner. The service is rendered, the account is settled, and when the patient is in need of further medical advice he probably goes to an entirely different man, who he believes is more especially qualified to treat the ailment which he believes he possesses. One might almost say that the transaction is entirely devoid of any personal confidential relation.

This condition can readily be explained because of the change which has taken place in our community life. It is no longer possible for the physician to memorize the personal affairs of all of his patients. The community has grown entirely too large. And where the old family doctor looked at the tongue, took the temperature, counted the pulse, felt the abdomen, and with one ear against the chest listened to the heart and lungs, and from what he saw and heard made his diagnosis, the doctor of the present day must at his peril follow an entirely different procedure. To the credit of the old family physician it must be said that after a wide clinical experience he was able to obtain a high percentage of accuracy in his diagnoses, but it must also be remembered that he was of necessity an artist and not a scientist.

Nowadays, when a patient presents himself to a physician, he tells his story and a complete physical examination is made. This is followed by the various laboratory tests, urinalysis, blood count, blood Wassermann test, gastric analysis, stool examination, and x-ray examination. To carry out these details requires that the physician himself must

spend hours or days on one patient or have assistants properly trained in the various specialties who can help him. Tersely, today more time is spent in arriving at a diagnosis than was spent under the old regime.

Interpreted in terms of money, diagnosis today costs infinitely more than the diagnosis of fifty years ago. Against the financial investment of the old family doctor, whose equipment comprised a small room, a desk, a table, two or three chairs, a thermometer, and a bag of instruments, and in the country at least, a horse and buggy, one is obliged to set up the cost of a suite of offices, laboratory equipment, x-ray equipment, automobile and various other appliances and apparatus. To this must also be added the cost of a stenographer or clerk, one or several nurses, and one or more assistants, depending upon the volume of business.

This change from the rendition of a purely personal service to the service of an organization involves an alteration of the doctor's viewpoint to correspond. It also involves a change in the viewpoint or the mental attitude of the patient who seeks what he thinks is the best service for the least money. That is, the average patient places the purchase of medical service on a commercial basis.

One of the outcroppings of this readjustment is seen in the frequent change of physicians by patients. The average patient is impatient, and if results are not obtained as quickly as he feels they should be, he seeks the services of some other physician about whom he has heard and who possesses the mysterious healing power attributed to the old family doctor.

The desire of physicians to meet this changed economic condition has induced too many to adopt means of publicity which are held unethical by the rank and file of the profession. No matter how sincere he may be in his purposes, whenever an individual physician attempts to educate the public on questions of health, those on the outside immediately assume that the compelling motive is one of personal aggrandizement.

No one questions seriously the need for greater knowledge by the public in matters of health. That being true, it would appear that the medical profession as an organization should find some way of communicating this knowledge to the public. Such an effort could not be criticised as a personal advertising campaign. The average member of the public is anxious to know more about questions of health and disease, so that he may govern his life accordingly. One of the best illustrations of this fact is the wide interest the public takes in the "Health Talk" columns carried by many daily papers. Another illustration is the extreme interest evinced by large audiences attending the public talks conducted by the Society for the Control of Cancer. These two concrete illustrations represent two methods which can be employed by the medical profession as an organization to promote better knowledge on the part of the public concerning medical questions, as they also indicate the need for organized and coordinated effort in this direction. The public press by and large is willing and ready to give space to medical problems of wide interest. As proof of this, attention is directed to articles lately published in the *Atlantic Monthly*, *Century Magazine*, *Woman's Home Companion*, *Ladies' Home Journal*, *Hearst's International*, and an announcement by the *Survey* that it has secured the services of Dr. Haven Emerson as associate editor in charge of a Department of Health and Preventive Medicine, which will be carried continuously.

There are other methods of reaching the public through the lyceum. Harvard University Medical School has conducted a series of lectures on medical subjects to which the public was invited. Attendance at these lectures has been far beyond expectation. Indeed, the interest has been so great that Harvard University is now publishing these

lectures as a series of monographs which will be placed on sale through the book stores. Each monograph is authoritative, is interesting and is written in language within the understanding of the average man.

Last winter the Mayo Clinic followed the same plan as Harvard University. A course of public lectures on medical subjects was given by members of the staff. One of the large churches in Rochester was obtained for the purpose and at each lecture the building was crowded.

The criticism may be offered that these methods are only practical for certain types of organizations such as large medical schools and groups. But this is not entirely true, for the medical society in each city, county or state furnishes a nucleus for a working organization representing the entire medical profession which can be called into service.

Where a medical organization sponsors such an undertaking, the personal element is eliminated. Material presented in this way is authoritative, and entirely devoid of appeal for any special line of therapy.

The Late Dr. Threlkeld-Edwards

ON September 30th last, Herbert Threlkeld-Edwards, of Bethlehem, Pa., died after a lingering illness of one and a half years. Dr. Edwards was personally known to a great many of the members of the Radiological Society of North America because of his active interest in the science of radiology, and his high professional attainments made him universally recognized as the stalwart and painstaking student whose labors added materially to the progress of radiology.

Dr. Edwards was born at Esher, Surrey, England, on March 30th, 1870. He studied under tutors in England, also attended Surrey House, and at the age of sixteen years accompanied his father, George Clayton Edwards, to this country.

He studied at the University of Southern California, then enrolled in the medical department of the University of Pennsylvania, and was graduated in the class of 1892.

After serving his internship at St. Luke's Hospital, Philadelphia, Dr. Edwards became demonstrator of pathology at the University of Pennsylvania, and remained as a member of the faculty for two years.

He then returned to Bethlehem, where he engaged in extensive professional endeavor for many years. Even under heavy professional demands, Dr. Edwards retained his habits of study and scientific research and developed the first American screen for intensifying x-rays. Of recent years he was actively engaged in the manufacture of this screen.

He devoted special effort to the study of roentgenology, in which he was a pioneer. Under his direction the modern

x-ray laboratory at St. Luke's Hospital was founded and he was the first director there.

Dr. Edwards gave careful study to the advance of medicine and surgery during the great war, and he gave devotedly and prodigally of his time and labor to secure this advancement in hospitals and laboratories at home and abroad. His intensifying screen was widely used by the American Expeditionary Forces in France.

He was a member of the national, state and county medical associations, the American Roentgen Ray Society, the Philadelphia Roentgen Ray Society, the Philadelphia Medical Club, the Alpha Mu Pi Omega Medical Fraternity, the Country Club of Northampton County, and the Saucon Valley Country Club.

He is survived by his wife, his daughter, Mrs. Gerald Thorp, and his grand-daughter, Elizabeth T. Thorp, of Bethlehem, his son, Herbert Threlkeld-Edwards, Jr., of the University of Pennsylvania, and three brothers in Southern California.

Research at Coe College

ANNOUNCEMENT from Coe College is to the effect that a 200,000 volt deep therapy equipment has been installed in the department of physics in order that a definite program of research with respect to the physical laws underlying deep therapy may be carried on.

Dr. A. W. Erskine of Cedar Rapids will work in conjunction with the University. Professor L. D. Weld, in charge of the Department of Physics, assisted by Mr. Scott W. Smith, will direct the physical work. For the time being, it is stated that investigation will be confined to the subject of filters, but as rapidly as possible will be extended to include other phases.

Literature of Radium Therapy

USERS of radium will undoubtedly be interested in two books lately compiled by the American Institute of Medicine for the United States Radium Corporation. One is entitled "Bibliography on Radium," compiled under classified headings, with reference to the uses of and results obtained from radium since its discovery up to January, 1922. The other is headed "Abstracts of Selected Articles on Radium and Radium Therapy," and is very complete.

This is the first published effort that has come to our attention to put in the hands of the user of radium a complete compendium of past and current literature for ready reference on this subject. Compiled as these books have been by the American Institute of Medicine, they may be accepted as accurate and without any suggestion of commercialism. They constitute a very valuable addition to the radium therapist's library.



CASE REPORTS

More Than One Thousand Carpet Tacks in the Stomach

HOWARD CURL, A. B., M. D. and L. C. CULVER, A. B.

Madison, Wisconsin

A SEARCH of the literature will soon convince one that foreign bodies in the stomach and intestines are not rare. That there are many cases which are never reported is certain. A case seen recently by us, however, seems sufficiently out of the ordinary to merit a report.

A review of the literature seems unnecessary with this report as any one sufficiently interested may with little effort find as much as is desired. We found one case, however, of sufficient similarity to be mentioned briefly: Marshall⁽¹⁾ reports a case of a woman 41 years old. Two weeks after her fifth confinement she vomited blood. She then became unconscious for

forty-eight hours. Her pupils dilated and her pulse was very weak. She recovered from this first attack, but was very feeble after a comparatively complete convalescence. Three years later she had a severe pain in the epigastrium and left groin. Upon examination a hard tumor mass was felt in the groin. It was about the size and shape of a placenta and it moved transversely when the patient shifted from side to side. Touching the body in this region produced vomiting although palpation was not painful. The patient also complained of pain in the shoulders and breast.

The menses were suppressed for three months. Constipation and con-

tinual vomiting (blood streaked) characterized the second attack. From this attack the patient apparently recovered except that the menses did not return. Five years later the vomiting returned and after three weeks the patient died. An autopsy showed the pyloric end of the stomach descended to the pubic. The pancreas was displaced. The duodenum was lying partly under the sigmoid colon. The cecum and colon were very small. There was no sign of peritonitis. The lower part of the stomach contained nine ounces of needles. The duodenum also contained a large number of needles, the total weight being over one pound.

Thanks to the x-ray and modern surgery, our patient is still living although more than two pounds of carpet tacks were removed from her stomach. Her history which extends over a period of four years is as follows: Twenty years of age, weight 110 lbs., height 63 inches. Past history of no consequence and family history negative, except that the entire family, the patient included, were a little below the average mentally. Patient was a candy dipper by occupation. Early in 1918 she had an attack of appendicitis and was operated upon by a surgeon at Madison. Attention was first called to her mental condition following the operation, when through one of the welfare associations it was found that she had torn the freshly healed wound open and would not let it close. Through constant attention of a physician from the University Clinic, the wound was finally closed.

She was next heard from a year later, spring of 1919, when she appeared at the office of Drs. Joseph and J. P. Dean and asked to see Dr. Joseph Dean and told him that while crossing the street she had fallen and broken a milk bottle and that she thought some of it had gotten in her eye. When the doctor saw that the lower lid was full of small pieces of glass he knew that they had been put there, but this the patient denied. He removed the glass and treated the eye

Double Cervical Ribs

R. H. SANKEY, M. D.

Oxford, England

THE accompanying radiograph shows the presence of double cervical ribs, the one on the left being longer than the one on the right and having

the appearance of a joint about the middle. This patient was a woman of fifty-five years.



and asked the patient to return the next day. This she did, but asked to see Dr. J. P., and to him she said that Dr. Joseph had removed some glass from her eye on the previous day, but that she thought there must still be come in the eye; there was, some twelve or fifteen small pieces. Two days later she appeared at the office of another physician with the same story and the same amount of glass. The glass was removed and the eye treated. This ap-

parently satisfied her for the time being, for she was not heard of again until the following fall. In the fall of 1919 she was stricken with severe abdominal pains. She had some symptoms of intestinal obstruction and gave a history of not having had a bowel movement for four weeks. This, of course, we did not believe, but she was put in the University infirmary for observation. She was given a barium meal and examined. Stomach was apparently

normal. There was a definite delay at the ileocecal junction. She was watched very carefully by the nurses, whose records showed that for eight days she had had no bowel movement. This was checked up by daily fluoroscopic examinations and at the end of eight days there was still barium in the terminal portion of ileum and the colon was filled. It was decided that she had obstructive adhesions about the cecum and Dr. Dean decided on a short-circuit (ileum to sigmoid colon) operation. This was done and the patient had an uneventful recovery.

Eighteen months later, April, 1921, the patient was taken with severe abdominal pains with vomiting. It was thought that perhaps adhesions had again formed nullifying the previous operation, and it was decided to give her a barium enema to determine if there was obstruction. The rectal tube was inserted and the enema started with the screen well down over lower abdomen. As the colon began to fill the screen was moved upward when we noticed a large dense dark mass occupying the region of the stomach. The enema was stopped. Upon close examination it was found that the mass seen was composed almost wholly of carpet tacks. The patient and her father refused to permit an operation. The case was brought to the attention of the Juvenile Court and an operation ordered. Drs. Dean performed a gastrotomy and removed from the stomach one thousand and forty carpet tacks, twelve screws, twelve safety pins, all of which were open, and many other small metallic pieces. The total contents weighed over two pounds. The patient had an uneventful recovery and has been perfectly well to date, almost a year and a half since operation.

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Drs. Curl and Culver—Roentgenogram of patient, showing carpet tacks, etc. in stomach and intestinal tract.

Fracture of the Skull

FRANCIS B. SHELDON, M. D.
Fresno, California

CASE No. 2749. W. W. Negro, male, adult. Entered the hospital in a semi-conscious condition. At this time there were bruises about the face, the lips being badly swollen. There was no other external evidence of trauma.

Radiograms were made and the extensive fracture of the skull shown in the accompanying plates was found. The fracture line begins on the right

near the occiput and extends forward across the frontal and back on the left to above the external auditory canal. On the right there is marked comminution and depression. Along the frontal there is considerable separation. There was a temperature of 101° F. the second day, after which temperature was normal. Patient rapidly gained consciousness and at no time complained of pain within the head. The extent of

the fracture allowed it to give to any pressure and this probably accounted for the lack of pain.

Later history gives the cause of the fracture as a brick bat striking him in the face, the propelling force of which was the arm of his intended.

This case is reported because of the extent of the fracture, the manner of its occurrence, and the absence of the usual symptoms of skull fracture.



Figure I.—Right lateral, showing the extent of the fracture on both the right and left sides of the head, also the comminution on the right.



Figure II.—Postero-anterior view, showing the fracture line across the frontal and the depression on the right.

Hour Glass Stomach

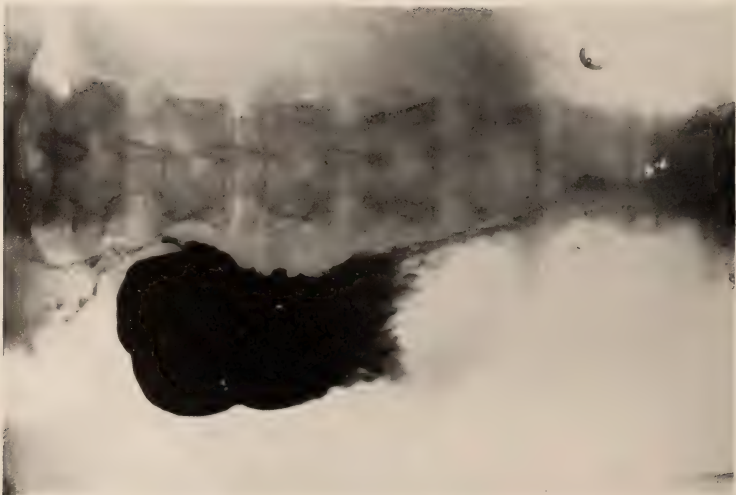
J. M. W. MORRISON, M. D.

Manchester, England

THE following case is of interest because of the pathology shown and because of the apparatus used in making the plate. It will be noted from the accompanying illustration that we are dealing with an hour-glass stomach

combined with an ulcer on the lesser curvature of the upper pocket. The patient is a woman of fifty-one years. The apparatus used for making this plate was installed in Ancoats Hospital, Manchester, England, in 1907.

It was the first x-ray plant in Manchester and is still in use. The technique used for making this plate was a sixteen inch coil with a mercury gas break with exposure of one second, using duplitized film and intensifying screen.



Radiography of the Os Calcis

RAY A. WATTERS, B. S., A. M., Sc. D.

Emory University, Atlanta, Georgia

IT IS the purpose of this paper, in the following series of radiographic reproductions of the os calcis, to illustrate what seems the simplest, most reliable, and easiest method of securing x-ray plates of this particular part of the human anatomy. The necessity of a position has a great deal to do with its invention; but the necessity for securing a normal x-ray shadow should stimulate a certain amount of caution that the position will not be overestimated.

The x-ray plate should present a picture of such clearness and detail as to make the pathology easily seen. In other words, the picture presented to the roentgenologist should be normal in contour, which is of the utmost value in determining both the normal and the pathological structure. There are times when the technician finds radiography rather problematic from the standpoint of abnormal rather than normal shadows. A normal shadow is essentially the fundamental principle of all x-ray interpretation. It is absolutely impossible to secure a correct reading of plates that present abnormal shadows. There is but one way to overcome this error, and that is by establishing standard relations between the source of the rays, the sensitized plate, and the part subjected to examination. The operator must ever bear in mind that often even a slight deflection in the relative positions of the target, plate, and part being examined will result in some distortion which perhaps might render the plate of doubtful value and therefore useless from the standpoint of diagnosis.

Experience has shown that the best results are obtained by closely adhering to standard positions; but it must be remembered that frequently these positions will have to be modified to meet the need of individual cases.

In presenting my position for the radiographic examination of the os calcis, I am not sure that it is entirely new. I have not, however, been able to find printed literature describing this position, and I have never observed its use in any of the many x-ray laboratories that I have visited. I am, therefore, forced to conclude that radiographic examination of the os calcis by this position is not generally known and at the present time is not in use.

The position most used at the present time for examination of the os calcis is that described in the "U. S. Army X-ray Manual" (see Fig. 2). This position is the standard position. The radiograph of the os calcis by standard position is secured by standing the patient on both feet. To illustrate: The right os calcis is to be examined. The right foot is placed on the plate, the left foot is placed firmly on the floor, approximately 24 inches in front of the right foot. The body is slightly bent forward, and the left knee is flexed anteriorly about 20 degrees. The right knee remains firm; the leg, however, is bent forward from the ankle (see Fig. 2). The target is run down within 20 inches of the plate; the tube is tilted to about 30 degrees. The central ray will enter over the tendon Achilles as shown by arrow in illustration. The result of this operation is shown in Figure 5.

The position herein submitted for your approval is less complex, and I believe more satisfactory than that of the now standard position. To illustrate: The patient, lying on his back, is made comfortable on the radiographic table. The right os calcis is to be examined. The right foot is slightly elevated by placing the heel on empty plate boxes as shown in Figure 1. The plate is placed directly under the heel, the posterior heel and tendon Achilles must rest firmly on the plate else the radiograph will be distorted. The foot is kept perpendicular to the plate. In a great many instances the patient is nervous and has a tendency to move the foot about, but this motion can be avoided by supporting the leg with sand bags. Two medium sized sand bags are sewed together by tape, which is of sufficient length to wrap around the phalanges and return to about five inches above the external malleolus. One sand bag is placed on either side of the foot, making a firm support for both foot and ankle. The target is drawn to about 19 inches distance from the plate; the tube is tilted 30 degrees toward the sole of the foot, making the point of entrance for the ray just above the heel (see Fig. 1). Results of this operation are shown in Figures 3 and 4.

It will be found that the technique is more easily acquired in the Watters' position. It has been the experience of the writer that in some x-ray laboratories it is next to impossible to make a radiograph of the os calcis by the standard position. If the patient is experiencing a great deal of pain, such as that from fracture, it is not advisable for him to stand. The standard position is more easily executed in laboratories provided with movable tube stands, but if the tube stand is mounted on the table the standard position is exceedingly difficult to execute. Usually a separate table must be provided for the patient to stand upon. Should the radiographic table be used for this purpose frequently the patient is too close to the high tension circuit.

In the Watters' position the discomfort of the patient is eliminated, and the mechanism may be manipulated



Fig. 1—Watters' position for x-ray of the os calcis.

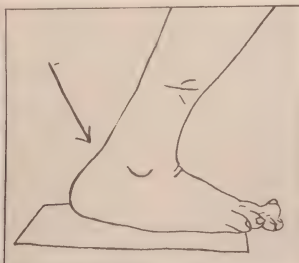


Fig. 2—Standard position for x-ray of the os calcis.

with greater ease and accuracy (see Fig. 1). As to final results obtained in both the standard and Watters' positions little can be said. With careful technique a perfect plate may be had in either position. It will be remembered, however, that it is not advisable to dispense with the lateral view of the

foot in cases of this nature. The lateral view is made with the target centered over first metatarsal.

CONCLUSIONS

1. The Watters' position is easier to acquire.
2. The patient is always comfortable.

3. The mechanism is more easily manipulated.

4. A correct and detailed shadow is obtained.

5. The results are as good, if not better, than those obtained by the standard position.



Fig. 3—Radiograph of os calcis, Watters' position.

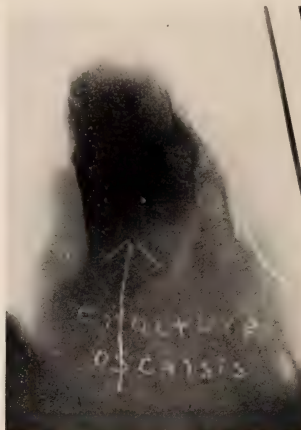


Fig. 4—Radiograph of os calcis, showing fracture, Watter's position.



Fig. 5—Radiograph of os calcis, standard position.

Treatment of Ulcers Resulting from Radiation of the Cervix

R. C. FINLAY, M. D.
Greenville, Miss.

SLUGGISH ulcers of the cervix, which frequently follow application of radium are very difficult to heal and cause the patient considerable annoyance.

The treatment of these ulcers has not been altogether satisfactory. Re-

cently, however, I have found that the application of a small amount of powdered iodoform directly to the ulcer has given me excellent results. I apply the iodoform powder on a paper trowel through a bivalve speculum, after which

the vagina is packed with gauze. Ulcers treated in this manner heal much more quickly than any other method which I have tried and the odor is so scarcely noticeable that it is not objectionable to the patient.



Commercial Exhibit, Annual Meeting

From the interest already manifested, it is safe to assume that the commercial exhibit at the annual meeting of the Radiological Society of North America, to be held in Detroit, December 4th to 8th inclusive, at Hotel Statler, will surpass anything of its kind in the history of the organization.

With all the available space sold and manufacturers and distributors of various appliances and apparatus clamoring that they be given room to show their wares, there is no question but that the capacity of the hotel will be taxed to the limit.

In this connection, it is probably only fair to say that the attendance bids fair to outnumber anything previously

of record in the science of radiology. A very comprehensive and instructive scientific program is being arranged, a scientific exhibit to which there has been nothing comparable in the history of the Radiological Society is assured, reduced railroad rates under the identification certificate plan will be in effect, and with the wide recognition that is being accorded radiant energy in its various forms both as a diagnostic aid and therapeutic agent, the meeting is sure to bring together an unusual number of men from all parts of the United States and Canada who are seriously interested in science.

The effort of the exhibitors will be to make their exhibits both interesting and educational. Each exhibit will be in the hands of competent men from whom information can be obtained without any embarrassment.

Exhibitors

Space No. 1—Patterson Screen Co., Towanda, Penn.

Space Nos. 2 and 3—Standard X-ray Co., 1932 N. Burling St., Chicago, Ill.

Space No. 4—Jno. V. Doehren Co., 208 N. Wabash Ave., Chicago, Ill.

Space No. 5—Radium Chemical Co., Marshall Field Annex, Chicago, Ill.

The Radium Chemical Company of Pittsburgh will have on exhibit the latest apparatus used in connection with radium work, and will demonstrate several new methods for handling radium. The present tendency is toward simplicity, and with that end in view, new instruments have been designed to simplify the handling and application of radium.

Following out the custom of having a radium conference in Pittsburgh either before or after all national meetings, we desire to announce that for this meeting the conference will be held from December 11th to 15th, and all members of the Radiological Society are cordially invited to be present.

Space Nos. 6 and 7—James Picker, Inc., 497 Lexington Ave., New York City, N. Y.

Space No. 8—Sagamore Chemical Co., Inc., 213-15 Water St., New York, N. Y.

Sagamore Chemical Co., Inc., New York, American distributors for "AGFA" x-ray films and plates, will have an elaborate exhibit, which is now being prepared abroad.

Space Nos. 9, 10 and 11—Engeln Electric Co., 4601-11 Euclid Ave., Cleveland, Ohio.

Space Nos. 12 and 13—Victor X-ray Corp., 236 S. Robey St., Chicago, Ill.

Chief among the apparatus which will be on display will be the new Victor Stabilized Mobile X-ray Unit, a recent Victor achievement, which is radically different from any type of x-ray apparatus heretofore offered to the profession. The three most outstanding features of this new unit are the Stabilizer, Auto-Transformer Control and Circuit Breaker. The merits of the Stabilizer are already apparent to the majority of x-ray users throughout the country. Not only does this device eliminate the disadvantages due to line fluctuations, but it furthermore means a considerable saving in tube and film costs, not to mention the freedom from worry, and the certainty of results which will accrue to the user. The Auto Transformer control furnished with this new

unit provides for twenty-six separate control steps, thus giving to the user a refinement of control that is truly ideal. The Circuit Breaker provided with this unit means not only protection to the tube, but also protection to the operator and patient.

Another Victor development which will be on exhibit is an improved type of stereoscope. This new outfit is the result of considerable experimental work by Victor engineers and combines features which make for a stereoscope of the utmost economy, simplicity of operation, beauty of design, and above all, even diffusion of light over the radiographs to be viewed, resulting naturally in more certainty in diagnosis.

The Victor line of Quartz Lamp Equipment will also be on display at the meeting. Both the Water Cooled and Air Cooled Lamps will undoubtedly attract the usual close attention on the part of the medical profession, but in addition there will be on display the new mobile hospital unit, which is designed so as to be conveniently wheeled from room to room.

Those in attendance at the meeting will also wish to carefully inspect the latest type of Victor High Frequency apparatus, a machine of portable construction delivering sufficient current for the treatment of any condition indicating the use of high frequency currents.

Space No. 14—Buck X-ray Co., 6629 Olive St., Rd., St. Louis, Mo.

This exhibit will consist of a display of X-Ograph Dental Film Packets, X-Ograph Developing and Fixing Chemicals, the X-Ograph Contact Cassette, and X-Ograph Universal Dental Film Mounts, including a dental film mount filing device and film viewer, incorporating a decided departure from the old method of mounting and viewing dental radiographs.

Space No. 15—U. S. Radium Corp., 58 Pine St., New York City, N. Y.

In addition to a complete set of screens and applicators of most recent design, the United States Radium Corporation will show two books prepared for it by the American Institute of Medicine. One will be a complete bibliography of radium literature which has appeared in the medical press both in the United States and abroad since radium has been used therapeutically. This volume will enable a doctor to locate articles on any subject by any individual, as it gives name of publication, volume and date. It is designed to be a real index to the literature of radium therapy, and as such fills a long felt need.

The second volume is "Abstracts of Selected Articles on Radium and Radium Therapy," which includes approximately three hundred articles by leaders in this field. It is divided into thirteen sections and the articles are grouped as nearly as possible according to specialties, such as gynecology, dermatology, ophthalmology and urology. The following quotation is taken from the foreword to the volume of abstracts:

"In presenting to the medical profession this book of abstracts from articles on the medical use of radium, prepared for us by the American Institute of Medicine, we feel that we are repaying in part the innumerable courtesies and kind assistance given us by so many physicians all over the world. The work is a very thorough one and will, we trust, be of service to users of radium who seek a ready reference to some of the world's writings on this very important phase of therapeutics."

Dr. Victor F. Hess, head of the Physical Research Department of this company, has designed a small emanation plant for use of two hundred milligrams and more of radium. This plant has solved a number of the difficulties which have hitherto confronted emanation users and occupies a very small space. It can be operated by any physician or institution. After a thorough test it is now in active use in the hands of a radium therapist of very high standing. Pictures of this machine will be shown and a representative will explain any points of interest.

Space Nos. 16 and 17—Liebel Flarsheim Co., 410-16 Home St., Cincinnati, Ohio.

Space No. 18—Sweetbriar Laboratories, Inc., 1220-28 Hodgkiss St., N. S., Pittsburgh, Penn.

This exhibit promises something of unusual interest in the way of work done with the new Sweetbriar screens.

Space Nos. 19 and 20—Waite & Bartlett Mfg. Co., 53 Jackson Ave. Long Island City, N. Y.

OIL IMMERSER UNIT—This comes in a tank 23½ inches long, 12 inches wide, 13 inches high. Mounted in the tank is the high tension transformer and a separate filament current transformer. Above this is placed the lead glass shield and 30 milliamperer radiator tube. The unit is shipped having the oil in a separate container. The tube goes in the regular crate. The tube holder, however, is arranged so that it is a very simple matter to put the tube in the lead glass shield and mount it in the tube holder, which is permanently attached to the under part of the cover.

There can be an opening in the top of the box for the x-rays to come through, or it can be placed on the side. It can also be arranged so as to take the same shutter that is used with our fluoroscope.

This unit can be mounted on a carriage under a fluoroscopic table, or it can be mounted between two uprights having a counter-balance adjustable for height.

NEW MODEL RADIOGRAPHIC AND FLUOROSCOPIC TRANSFORMER WITH OIL IMMERSER AUTOMATIC THROW HIGH TENSION SWITCH—This transformer is in a tank 16 inches long, 12 inches wide, 14 inches high. In this tank is mounted a high tension transformer, filament current transformer and double throw automatic high tension switch. There is a double set of high tension terminals coming out of the top. When this is connected with the control cabinet or control panel, the high tension switch is automatically thrown one way or the other, according to whichever foot switch the operator steps on. This does away with having to stop to turn the high tension switch or to even give it any thought. A still greater advantage is that it does away with the oxidation which takes place in the filament

circuit of the ordinary exposed high tension switch, causing trouble.

NEW MODEL CONTROL CABINET FOR THIRTY MILLIAMPERE TRANSFORMER—The same equipment, instead of being in cabinet form, the cabinet mounted on a slate base so that it can be readily placed against the wall.

This control cabinet can be used either with the fluoroscopic transformer or with the oil immersed unit. The switch-board or cabinet, contains the following:

Coolidge meter, voltmeter and milliammeter.

Auto-transformer adjustable in two-volt steps.

Adjustable overload circuit breaker with double silver contacts opening both sides of the line.

Automatic current regulator which will keep the milliamperes constant at five or thirty. This is controlled by means of a two-way switch which is marked "Fluoroscopic and X-ray."

Two connections for floor switches to be used either singly or in combination with the fluoroscopic transformer, having an automatic high tension oil switch.

A plug connection for floor foot switch. This is arranged so that it is impossible to use 30 milliamperes except when the switch is on the side which enables you to use the foot time switch. In other words, you cannot possibly turn on 30 milliamperes with the ordinary foot switch.

There is another outlet which can be connected with a red light overhead so that when the foot switch is used the red light automatically goes out.

NEW MODEL G-U MASSACHUSETTS FLUOROSCOPIC AND BUCKY DIAPHRAGM TABLE—This consists of a table having the Bucky Diaphragm permanently attached to it and movable. At one end underneath is placed an oil immersed fluoroscopic unit which is adjustable six inches each way. Attached to the base of the Bucky is an upright which supports the oil immersed unit, arranged so that the rays come out of the bottom of the tank. This is accurately centered over the center of the Bucky so that after the operator has made a fluoroscopic examination, he can, without moving the patient, simply push the Bucky down to the other end of the table under the patient; the Bucky having been previously loaded with the film. The control board can be mounted at one end of the table if desired, so as to eliminate all wiring possible.

NEW AND ORIGINAL MODEL STEREOSCOPE—This is mounted on a counterbalanced stand so that the operator can sit down in a comfortable chair in front of it and make his examination without any discomfort.

The illuminating boxes are novel in construction, the curtains being placed inside of them but being adjustable from the outside. This enables the placing of a cross-bar so that the films can be readily held in position without any difficulty.

This apparatus stereoscopes very much easier than the ordinary type owing to the fact that the operator looks directly at one plate with one eye; while the other eye looks at the mirrored surface. It is hard to believe what a very great difference in clearness this arrangement results in.

UNITED STATES ARMY MOBILE UNIT—This is the model such as was made up for the U. S. Army in conjunction with the late Professor John S. Shearer of Cornell University, and represents the result of his experience in France. It has been designed with a view to economy of space without losing the advantages of universal adjustments.

This is in a cabinet 20 inches wide, 24 inches deep, 36 inches high. There is a 35 foot service reel permanently attached in the cabinet to be connected with the electric light service. There is space so that a rotary converter can be used to operate up to ten milliamperes, and mounted in

this unit. The sides are all removable, so that every part is accessible.

This is a unit which every hospital should have. It will do all kinds of radiographic and fluoroscopic work. It is, of course, not suited for therapy or for instantaneous work; but it will answer the requirements of any small hospital.

LATEST IMPROVEMENT ON 10 K. W. INTERRUPTERLESS MACHINE FOR ALTERNATING CURRENT—
This 10 K. W. Interrupterless Machine has been improved in the following ways:

All makes of alternating current interrupterless machines have polarity indicators; so that when the apparatus is put into operation the operator is supposed to look at the polarity indicator and then turn the pole changer switch one way or the other. If, however, he fails to do this and closes the operating switch, the polarity may be wrong and the possibilities of puncturing a tube are very great.

With this new arrangement, this is all absolutely avoided. It is simply impossible to turn on any high tension unless the polarity is correct. When the machine is started up there is a red light. If this lamp lights up the polarity is wrong. If, however, the operator neglects to pay any attention to it and goes ahead and closes the operating switch, nothing will happen, he simply cannot get any high tension. He will then, of course, look to see what is the matter and notice the red light, which means that the pole changer should be turned in the opposite direction. This device is exceedingly simple and there is nothing whatever to get out of order.

This unit also carries an auxiliary contact. This is for use in making automatic stereoscopic exposures in combination with the new electric-trip stereoscopic tubestand and electric-trip vertical plate changer. In order to do stereoscopic work with the new equipment, it is simply necessary to load the plate changer, place the patient in position, and have the tube in position for the first exposure. The operator then simply closes the operating switch. This will make the first exposure, and the instant it is over the tube will shift and the plate changer will revolve. During this period the time switch will reset itself; and the instant the second plate comes into position the second exposure will be made and cut off.

Space No. 21—French Screen Co., 406 McKerchey Bldg., Detroit, Mich.

Space Nos. 22, 23 and 24—Kelley-Koett Mfg. Co., Inc., Covington, Ky.

Space Nos. 25 and 26—Radium Co. of Colo., Radium Bldg., Denver, Colo.

The Radium Company of Colorado will exhibit a complete line of radium applicators and accessories. In addition to the usual instruments which have been regularly furnished with radium, the equipment shown will include numerous accessories of new designs.

The gold needle with platinum-iridium tip has been discontinued and needles of platinum-iridium or non-corrosive steel, are recommended. Possibly the most interesting development in needle design will be the new short length non-corrosive steel needles containing five milligrams each. These needle applicators, which are exactly one-half the length of the ten milligram needles and identical in external diameter, will be shown with accessories to facilitate application. The advantage in using the short needles of this design in conjunction with the standard long ten milligram needles will be demonstrated, with reference to the adaptability of standard screens.

A slender needle designed to contain three or five milligrams of radium element will also be included. Platinum-iridium needles of sufficient wall thickness to absorb all Beta radiation will illustrate the prevailing tendency in French design of such radium applicators. Brass capsule screens to contain needles have recently been added to the equipment not shown in the company's catalog.

Among new accessories for needles is a new type of needle introducer which has practically eliminated every difficulty in threading. The instrument is designed for imbedding non-corrosive steel needles. It will be shown in six, eight, ten and twelve inch lengths.

Another needle accessory is the flexible needle-holder, designed for use in conjunction with some standard form of operating cystoscope. This special needle introducer is supplied to meet a demand for a simple attachment for any standard instrument to avoid the necessity of duplicating the expensive lens system and other parts of the entire cystoscope. As an operating cystoscope is invariably found in the urologist's armamentarium, the new accessory will probably meet with general approval.

The result of considerable study and co-ordination of ideas obtained from numerous radium therapists will be seen in a new form of esophageal applicator. The chief advantage claimed is the simplicity of design. The instrument will be shown in various sizes to contain either glass radium-containing tubes or metal needles.

A new form of metal lined carrying case for radium needles will be shown. This case has been designed to accommodate the wires attached to needles, thereby providing a satisfactory container to hold the needles when ready for application. The number of needle compartments is made to meet individual requirements.

Metal-covered plaques in the design of which a marked departure from existing practice has been made, will be shown with records to illustrate the advantage of the new instrument over the older form of composition-covered plaques. The radium in the new flat applicator is distributed directly beneath a very thin layer of Monel metal, which permits the passage of approximately three times as much beta radiation as escaped through the much thicker layer of composition. These plaques are shipped in new lead-lined carrying cases which will also be included in the equipment shown at the Radium Company of Colorado booths.

* Adaptable applicators have been designed to facilitate the application of glass tubes or metal needles in the treatment of skin conditions. Several types of these instruments will be shown, including applicators to hold two glass tubes in separate compartments, and instruments to contain five or more needles. In each instrument the primary applicator is held in position beneath a very thin layer of non-corrosive steel.

Several forms of very practical distance applicators will be shown, including a special form of eye cup to hold radium tubes or needles at a distance of approximately twenty-five millimeters. The distance applicators and eye cup are supplied with special sheet-metal screens of various thicknesses. A convenient screen of gold-plated brass, moulded to fit the contour of the eye may also be mentioned.

Among the general accessories will be included, Balsawood for blocking radium away from the skin. It is an extremely light weight wood, highly recommended on account of the ease with which it may be cut to the required shape and also because it absorbs very little gamma radiation. A special grade of Kerr's Dental Compound, Bronze Ligature Wire for radium needles, sheet-lead in various thicknesses and special forms of pure rubber tubing will also be exhibited.

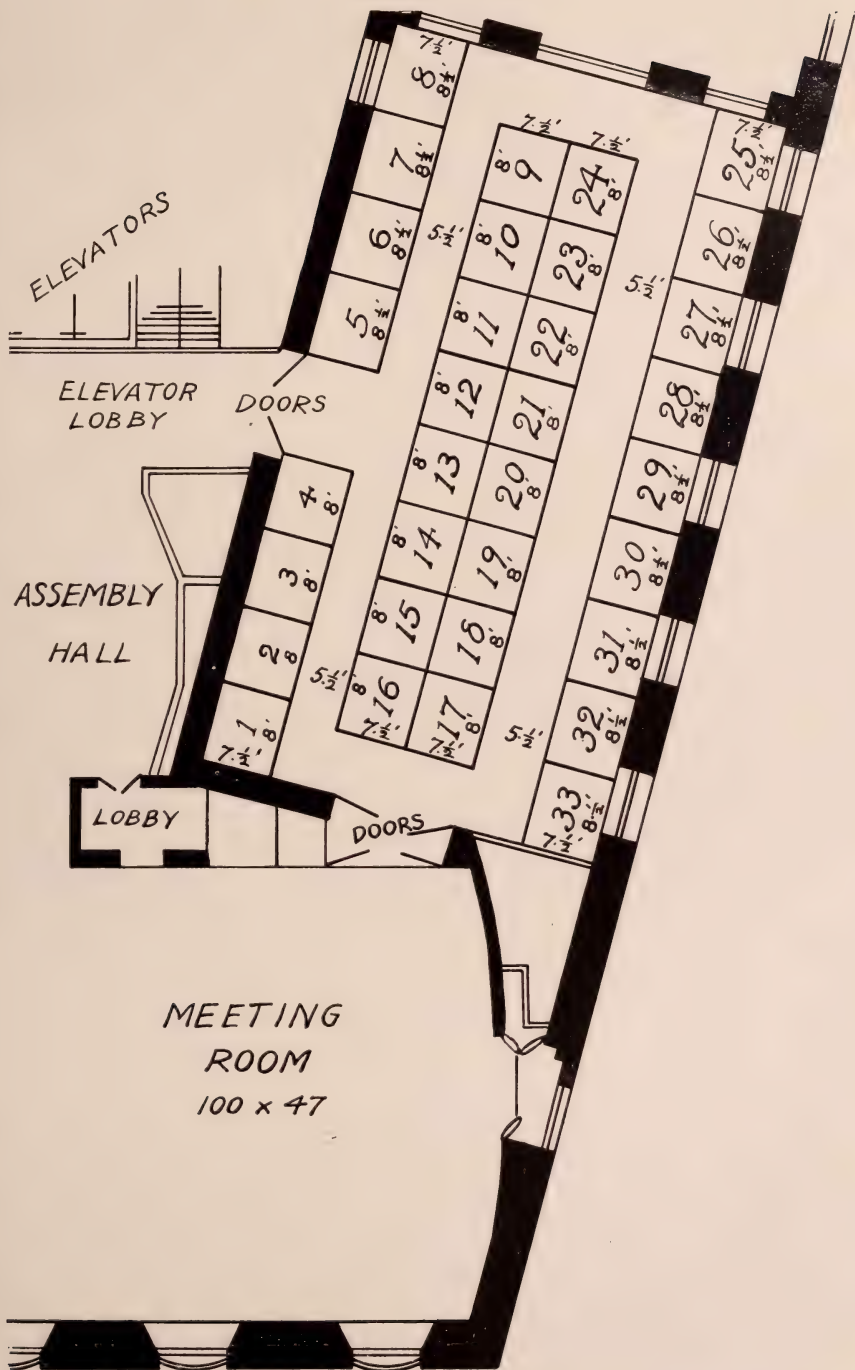
The above mentioned articles are some of the new accessories which, together with the other instruments that the company has regularly furnished its clients, will be demonstrated by representatives, who will be in attendance at booths twenty-five and twenty-six during the entire session

of the Radiological Society meeting.

Space Nos. 27, 28 and 29—Acme X-ray Co., 341-51 W. Chicago Ave., Chicago, Ill.

Space Nos. 30, 31, 32 and 33—Wappler Electric Co., 162-84 Harris Ave., Long Island City, N. Y.





ABSTRACTS *and* REVIEWS

The Radiological Clinic of the Philadelphia General Hospital. Joseph C. Doane, M. D., Mod. Hosp., 19:213, September, 1922.

PHILADELPHIA has the honor of being the first city in this country to purchase radium for the treatment of neoplastic disease in a municipal hospital.

The staff of this radiological clinic consists of a dermatologist, surgeon, urologist, gynecologist, radiologist, laryngologist, oral surgeon, internist, pathologist, physician, and senior assistant medical officer.

The staff with all its assistants holds a regular staff meeting weekly. Each chief has a designated hour for conducting his clinic when all treatments are given and return cases examined.

Two visiting physicians are in general charge, one in charge of diagnostic work and one in charge of therapy. A full time radiologist with his assistant follows up the treatment and supervises dressings. He is responsible for placing and removing all applications.

A graduate nurse is in charge of the clinic and there is also one on each ward with as many pupil nurses as the occasion may call for.

Eighty hospital beds are provided in the hospital proper and in addition there are two four-bed wards located in the clinic suite for the use of ambulant patients.

The clinic is equipped with a high voltage machine having a twenty-inch spark gap. Two grams of radium have been purchased for therapeutic use. The physical laboratory consists of an emanation room, a technical tool shop for constructing apparatus and instruments for use in radium treatments, a measuring room and a preparation room.

A physicist, a technician and a glass blower are employed in the transfer of röntgen emanation from the radium solution in the laboratories.

The cooperation of all members of the medical profession is sought in order that cases shall be early referred for treatment. Benign as well as malignant growths are referred to the clinic. The electrothermic method of coagulation is used for removal of sloughs in advanced cases of malignancy.

Six research problems have already been started with the cooperation of the radiological department, and a radiological library located in the radiological research room of the laboratory is

being collected to facilitate research work.

The Value of Radium in Gynecology. John A. McGlinn, M. S., M. D., F. A. C. S., Therap. Gaz., 46: 609, September 15, 1922.

THE EVILS of over-enthusiasm upon the subject of radium therapy are first commented upon by this author, but he adds: "Negative harm will also result from the failure of the skeptic to use it in cases when it is distinctly of greater value than surgery. Equally bad results are apt to obtain from the use of radium by the surgeon who knows pelvic pathology and diagnosis, but nothing of radium technique, as by the radiologist who knows radium technique, but nothing of pelvic pathology and diagnosis."

A trained radiologist working with a trained gynecologist is the ideal procedure, but when this is out of the question then each specialist must perfect his knowledge of the other specialty if he is to do his duty by his patients.

Radium banks, if properly controlled, serve a very useful purpose, but if they rent radium indiscriminately to the competent and the incompetent radiologist alike they are a menace to the public.

"In general radium has proved of distinct value in the treatment of malignant disease of the pelvic structures, uterine fibromata, uterine hemorrhage, leukorrhea."

In regard to malignancy he says: "Radium in a true sense is not a competitor of surgery; it is simply a most valuable addition to our armamentarium in the treatment of inoperable, gynecological cancer." In late, cases there is nothing which gives such brilliant results as radium. Experience alone can decide whether radium should supplant surgery in operable cancer of the cervix; time enough has not elapsed as yet to make positive and conclusive statements with regard to this. The author at present uses radium in the growth and follows this with radical hysterectomy. He believes that radium will eventually supplant surgery, but the time is not yet.

In cancer of the body of the uterus surgery is the method of choice. In that of the vagina and vulva radium and x-ray therapy are the preferable forms of treatment.

X-rays and radium will cure fibroid tumors of the uterus in properly selected

cases, but this is a very important qualification. In general, radium should not be used in infected tumors or in those with infected adnexa; in necrotic tumors; in those associated with malignant disease of the body of the uterus or diagnosed malignant changes of the tumor itself if still operable; in young women if avoidable by surgery; in stony hard tumors; in very large tumors or those causing distressing or dangerous pressure symptoms.

In uterine hemorrhage "radium is a sure and prompt hemostatic for all uterine bleeding not due to cancer, fibromata, other neoplasms, retained secundi, or perituterine inflammations. * * * In the myopathic and endocrine bleeding in younger women it should be used only after other measures have failed to effect a cure."

In cases of cervical leukorrhea radium in small dosages is useful, but the age of the patient is here a factor as in the lesions discussed above.

"Radium is the greatest addition to gynecic therapy in a generation. Used when indicated in the proper manner it is a wonderful servant; when enthusiasm for its use warps judgment it is a bad master."

Röntgen Treatment of Carcinoma of the Portio Vaginalis. Dr. Martius, Bonn. Deutsche med. Wchnschr., 48:977, July 21, 1922.

A CASE of inoperable carcinoma is here reported. The patient, 59 years of age, had a very large tumor extending a finger length back of the introitus vaginae and there was a spreading infiltration of the pelvic wall of at least the thickness of the thumb.

This case was treated with both radium and roentgen rays. Forty-five milligrams of radium element with one and one-half millimeters of brass filter were used. The exact location of the tumor underneath the skin was determined by the aid of a specialized form of compass with curving ends. If the extreme point of one leg of the compass is brought to rest over the intravaginal growth the other end will, upon closing the compass as far as the body surface permits, rest upon the skin just above the growth and the distance is then calculated by mathematical formula. Not more than five fields are used and these are located upon the abdomen, the back, the gluteal region and that of the vulva. The dose must be so calculated that when it reaches

the tumor it will have the same intensity as an erythema dose has at the surface.

Treatment of this patient had begun six months before the presentation of this paper and at the time of presentation she was clinically cured and had gained eleven pounds in weight.

Many physicians take the attitude that roentgen treatment of inoperable cases of carcinoma of the uterus is not worth while. The author believes that not only is treatment in these cases decidedly worth while, but that the physician who fails to advise this treatment is not doing his duty.

Roentgen Ray Therapy in Disturbances Due to the Menopause. Franz Groedel, M. D., Frankfurt. Muenchen. med. Wchnschr., 69:423, March 24, 1922.

DISTURBING symptoms often persisting for years after cessation of the menopause, and often leading to mistaken diagnoses, are an unnecessary drain upon the patient's health and general well being.

The author of this article believes that these symptoms are largely due to functional derangement of the glands of inner secretion, especially of the ovary, and he cites a number of observations in support of this theory.

Roentgenotherapy of these cases is advocated by the author and has yielded good results in his practice. Stimulating doses of the rays are given the ovaries.

Roentgenotherapy of Tumors of the Hypophysis and of Gynecological Lesions of Hypophyseal Origin. Dr. Blumberg, Berlin. Muenchen. med. Wchnschr., 69:739, May 19, 1922.

THE HORMONE theory of therapeutics, although only in its infancy, is exerting considerable influence.

Raying the pituitary body was first practiced by Cramagna and Beclere and later by Günsel and Kueppferle. Szilly, Darier, Fleischer and Juengling, as well as Schaefer and Chotzen, used this form of treatment for tumors of the hypophysis, and for gigantism and acromegaly. Lately (1921) Fraenkel and Geller in treating certain gynecological disorders have made use of this same method because experimental and clinical studies have led them to the conclusion that certain of these disorders have their origin in a disturbed function of the hypophysis.

The author has used the method with good results in several cases (one of tumor and three of dysmenorrhea)

and believes that the method will continue to prove of value.

End-Results of Operations for Cancer of the Breast. Frank E. Bunts, M. D., Ann. Surg. 76:341, September, 1922.

END-RESULTS gathered from the available records of his own cases, which number 600, are the basis for the conclusions reached by this author.

He states that type of cancer, age and hereditary predisposition of the patient all influence the results in any series of cases and that unless statistics are grouped with these factors in mind they are of little value in arriving at conclusions as to end-results.

His conclusions are: "(1) The successful treatment of cancer of the breast as of any other condition should be strictly individualized. (2) The ultimate senesce depend more upon the stage and dissemination of the growth when it is presented for treatment than upon any defined method of operation. (3) Greatly increased data regarding the value of pre and postoperative use of the x-ray and of radium are required before final conclusions can be drawn, although there seems to be little doubt of the value of radium applied directly in the axilla. (4) The substitution of the x-rays or of radium for surgical treatment cannot safely be considered at the present time. (5) The early removal of any growth remains the one and only sure method of treatment."

He states that in his earlier cases he gave postoperative x-ray treatments as a routine procedure, but later discontinued them because there seemed to be unusually rapid recurrences in many cases so treated. "With the establishment of more certain methods for measuring the dosage, we have tentatively resumed the use of the x-ray and are carefully watching the results. The use of deep x-ray therapy in the treatment of cancers of the breast to the exclusion of operation opens a hopeful, but thus far non-productive, field of speculation."

Results of the Treatment by Radiation of Primary Inoperable Carcinoma of the Breast. Burton J. Lee, M. D., Ann. Surg. 76:359, September, 1922.

A BREAST clinic was established in Memorial Hospital, New York City, in the fall of 1919, and a systematic effort has since then been made at this institution to study the whole problem of carcinoma of the breast.

All patients included in this present report have been admitted during the years 1918-1920. The last case began treatment sixteen months ago.

A primary inoperable carcinoma of the breast is defined as one in which appears one or more of the following factors: Fixation of the breast tumor to the chest wall; involvement of the supraclavicular nodes; definite involvement of the opposite axillary nodes; diffuse subcutaneous nodules; diffuse inflammatory carcinoma involving a considerable skin area; chest metastases—pleural or mediastinal; more remote metastases. "All surgeons will not, perhaps, be in accord with these indications of inoperability."

The rate of growth of these primary inoperable carcinomas can be considerably checked with consequent regression and sometimes disappearance, while involved nodes in the axillary or supraclavicular regions will likewise often regress and often disappear. A fixed breast tumor may be rendered mobile and thereby operable, so eliminating subsequent ulcer. Relief of pain in some measure, sometimes very marked relief over a considerable period, follows radium.

The author's technique for radium and for roentgen treatment is given in the original paper.

In his general conclusions, besides the points already mentioned above, he includes the following ones: "The patient must be kept under constant clinical observation. The type of radiation must be properly selected for each individual case; no routine prescription will suffice. Overtreatment by radiation must be avoided. Very advanced cases are unsuitable for any form of treatment. The palliative operation following properly planned radiation is of service in well selected cases. A cooperating social service department makes a follow-up system effective and gives humanitarian relief to the hopeless cases. The results to date are very gratifying and encouraging. As the disease itself and the technique of radiation becomes better understood, we believe that more and more satisfactory results will follow and that the possibility of the still further control of the disease by radiation may ultimately be realized."

Disturbances in Mammalian Development Produced by Radium Emanation. Halsey J. Bagg, M. D., Am. J. Anat. 30:133, Jan. 5, 1922.

A DEFINITE quantity of common salt was exposed to a comparatively large amount of radium emanation, and to the radio-active salt thus obtained sufficient water was added to make a physiological solution. Pregnant rats were injected subcutaneously in the shoulder region and intravenously through the caudal vein with three to four minims of this solution which ex-

hibited all the known phenomena of radium metal; alpha, beta, and gamma rays were present, the alpha rays producing the greatest physiological effects, it is thought. Five millicuries was found to be the maximum amount applicable for the aims of this experiment.

In a second method gamma ray radiation was applied through the ventral wall of pregnant rats at nearly full term. An amount of emanation was used equivalent to one and one-half grams of radium metal, filtered by two millimeters of lead and one-half millimeter of silver, the source of emanation being one centimeter away from the animal. A dose of 1300 mc. hours produced developmental arrests in the embryos, but did not kill the pregnant animals. Doses as high as 2900 mc. hours were successfully used in some cases. Embryos were killed by ether, and histological material was secured at various periods after treatment. Tissues were fixed in Bouin's solution and stained with hematoxylin and eosin.

The report of this study covers 18 pages of text. The author's conclusions are:

"1. The marked selective action of radium emanation on fast growing embryonic structures was noted in these experiments.

"2. Very decided developmental arrests occurred in the differentiation of the nervous and reproductive systems of mammalian embryos exposed to radiation toward the end of pregnancy.

"3. Experimental animals with greatly reduced, or practically no neopallium, gave apparently normal neurological behavior, except for blindness.

"4. Radium emanation used either in the form of a radio-active solution injected into the adult female, or employed as an external gamma ray radiation, produced marked areas of extravasation in the subcutaneous connective tissue of the developing young. This suggests that the action of radium emanation might be selective upon the endothelium of blood vessels.

"5. Extravasations occurred in the developing young of females treated with radio-active solutions a considerable time before fertilization, and suggests that in some way the faculty of the later developing embryos to form proper blood vascular endothelium had been interfered with.

"6. The results so far obtained indicate that gamma ray radiation is a physical agent admirably adapted to the study of experimentally produced developmental arrests in mammalian embryos.

"7. When women are subjected to therapeutic irradiation, especially during the early stages of pregnancy, the clinician should be forewarned con-

cerning the possibility of producing very grave disturbances in the developing child."

Some Effects of Radium Emanations on White Mice. Drs. Kaenematsu Sugiura and Gioacchina Failla, J. General Physiol., 4:423, March 20, 1922.

MICE were exposed to radium rays soon after birth and during the period of rapid growth. Control experiments were carried out under identical external conditions upon animals as nearly as possible like the radiated ones.

The radium emanation, mostly beta rays, was inclosed in glass tubes which rested upon a very thin sheet of mica rigidly suspended at a distance of two centimeters over the animal, which lay on a cavity covered by another very thin sheet of mica. Exposure was over the central dorsal region or over the head, for five minutes in every case.

A dose of 2.4 mc. hours, fractionally applied for a period of eight weeks, accelerated the growth; the weight of the irradiated mice exceeded considerably that of the controls until the twenty-seventh week, when weights of the two groups became about the same.

A dose of 11.5 mc. hours had no effect on body weight, but caused the eyes of the new born mice to open from 12 to 24 hours earlier than did those of the controls. A dose of 29.9 mc. hours markedly decreased the growth until about the forty-fifth week, when the average weight of the radiated mice became about the same as the controls.

A dose of 31.6 mc. hours resulted in death the twelfth day; one of 36.5 mc. hours resulted in death the ninth day.

A dose of 2.4 mc. hours, though producing no visible skin changes, rendered female mice permanently sterile. The males, owing to the fact that under the conditions of these experiments the reproductive organs were farther situated from the source of radiation and better protected by intervening tissues than was the case with the females, were not rendered sterile even temporarily by any dose, even one close to the lethal dose.

The Effects of Radium Rays on Metabolism and Growth in Seeds. Alfred C. Redfield and Elizabeth M. Bright, Laboratory of Physiology, Harvard Medical School, J. General Physiol., 4:297, Jan. 20, 1922.

RADIATION of radish seeds with beta and gamma rays showed that while germination was delayed and sometimes prevented entirely, the seeds were not killed. This latter fact was

proved by their undiminished production of carbon dioxide.

The observation is made that "Changes in the rates of carbon dioxide production and cell division do not always go hand in hand; one may be increased by exposures which retard the others. * * * Malformations of embryos must be due to an unequal effect on various processes which go on side by side. If all processes were affected alike their courses might be run more rapidly or more slowly, but at any instant the conditions of equilibrium in the tissue would not be abnormal. It is the specific action of radiations on certain physiological processes in contrast to others which accounts for the characteristics of their effects. * * * Consequently, it is unjustifiable to make any general assumption concerning their action on the chemical changes of living matter as a whole."

Action of Beta Rays of Radium on Excitability and Conduction in the Nerve Trunk. Drs. E. S. and A. C. Redfield and A. Forbes, Am. J. Physiol., 59:203, February, 1922.

THIS is a study of the effects of excitability and conduction produced by exposing the nerve trunk only (of the frog) to radiation. Controls were used throughout. The source of the radiation was radium emanation in amounts from 12 to 180 mc., according to the experiment under way. The emanation was inclosed in glass tubes approximately 1 mm. in diameter and 7 to 15 mm. in length; consequently the effects were due to the beta and gamma rays, the former predominating.

Very intense radiation with beta rays, it was concluded from these experiments, destroys the functional capacity of a nerve trunk. It is interesting to note that cells in mitotic division are supposed to be especially sensitive to radiation and that of all tissues the nerve tissues are perhaps the farthest removed from the capacity of mitosis.

It was further concluded (2) that in the nerve trunk "there may be a marked latent period between the termination of radiation and the loss of function * * (3) The disturbance of function is one which involves both conduction and excitability * * * in the early stages at least, conduction occurs with a decrement so that an impulse set up in the middle of the improvised region will be conducted through the remainder of it, while one set up outside of this region will fail to pass through the whole of it. * * *

Effects on excitability are shown when the stimulation is applied in the radiated region. In several experiments with an intensity of radiation so moderate as to produce the disturbance very gradually,

a slight increase in excitability was found, followed by a fall. In the majority of cases, especially in those in which the radiation was more intense, the first and only effect of the rays was to decrease excitability and this decrease usually occurred before conduction had been so far impaired as to establish a complete block to any impulse set up proximal to the radiated region. (5) Correlated to the loss of function of the nerve trunk is a stiffening of the tissue, and this appears to be more marked the greater the radiation. Microscopic examination reveals fatty degeneration of the myelin sheath."

Factors Which Determine the Concentration of Calcium and of Inorganic Phosphorus in the Blood Serum of Rats, Dr. Benj. Kramer and John Howland. Bull. Johns Hopkins Hosp., 33:313, September, 1922.

"THE concentration of neither element has been distinctly increased beyond normal limits, either as the result of various additions to the diet or the use of physical agents. It seems fair to assume that this cannot be done by either of these methods. On the other hand, it is possible to reduce the concentration of these elements in the serum by feeding diets containing an insufficient quantity of the respective elements."

It was found that starvation, the addition of phosphorus to the diet in organic or inorganic form, the addition of fat to the diet, or exposure to radiations from various sources yielding wave lengths of less than 3000 Aengstrom units will increase the serum phosphorus to a marked degree.

Blood Change in Myelogenous Leukemia Following Radium Treatment. B. R. Whitcher, M. D., Bost. M. & S. J., 187:350, September, 1922.

I EUKEMIA, its history, pathology and treatment is discussed in this paper and a case report is given.

Judicious and persistent use of x-ray or radium has been shown to have a markedly beneficial effect on the patient's health. Medication by benzol is also of benefit but the effect is not so marked as that following radium or x-ray.

Gilbert, Paris, reports that the cure by these agents is not ordinarily permanent and that the effects progressively decrease after the first "cure." Peabody reports practically to the same effect, as does also Gulland, who adds that radium treatment is preferable to x-ray because benefit from it is more quickly apparent and more certain than from x-rays. Metcalf regards radium treatment as excellent for this disease,

but believes the doses must be massive and frequent, otherwise abnormal activity is stimulated.

In summing up his observations, particularly those upon the case reported, the author says: "The observations show, on the one hand, that the application of radium in myelogenous leukemia does produce an apparently beneficial effect on the patient, if the amount of radium applied is regulated with caution, as the leukocyte count is reduced to nearly its normal level, the myelocytes are greatly decreased, and at times made to disappear altogether, the blood is brought to a more nearly normal appearance, and an apparent general improvement takes place in the patient's clinical condition. But the treatment needs to be given at regular intervals. On the other hand, the study of this case indicates that radium is a factor fraught with danger, and that caution is necessary in regulating the amount to be applied, lest an excessive amount of radium or too frequent application may cause undue destruction of the leukocytes, and so injure the reproductive powers of the bone marrow that a rapid leukopenia and anemia result.

"While Mr. Metcalf in his treatment of myelogenous leukemia with radium has applied it over the sternum and epiphyses of the femora, and humeri, as well as over the enlarged spleen, it has been deemed of late, here at the Post-Graduate Hospital, to be a better procedure to apply the radium over the enlarged spleen only, and the lymph nodes, if enlarged, but to let the bone marrow alone, until the myelocytes have entirely disappeared from the blood. There appears to be danger that in treating the bone marrow at the same time, its power to produce new red cells may be weakened so that the red cells and hemoglobin decrease along with the leukocytes. However, much more experience will be required to ascertain exactly the effect to be expected and the best mode of applying radium therapy in this disease."

Hits and Misses in the Diagnosis of Skin Eruptions. C. Piper, M. D., Johannesburg, South African Med. Rec., 20:268, July 22, 1922.

I N A DISCUSSION of psoriasis the author cautions against the administration of arsenic subsequently to x-ray treatment, since, even months after treatment, it may excite a very marked erythema.

A Criticism of Recent Interpretations of Annular Shadows in Lung Roentgenograms. M. P. Burnham, M. D., and Philip King Brown, M. D.,

Am. Rev. Tuberc., 6:469, August, 1922.

A CCORDING to the authors' views all annular lung shadows should be considered cavities until study by every possible means justifies some other interpretation.

They disagree with Sampson, Herse and Brown, and also with Amberson, all of whom consider these annular shadows to be indicative of pleural disease. Drs. Burnham and Brown say: "We believe that the theories advanced by these authors are interesting, but wholly unconvincing and unsupported by proof of any kind, and particularly not by autopsy."

By means of a device which makes films of the lung routinely in one-fourth of a second, thus cutting to a minimum transmitted motion from the heart and aorta, they have secured greatly increased detail in films. A perfectly definite opening of a bronchus into a cavity, at or near its lowest point, has been observed in three cases of annular lesions of unusual type. The authors find that in certain cases cavities may form rapidly and disappear the same way.

The effects produced by artificial pneumothorax in unilateral cases, the authors believe, offers additional proof that they are right in their conclusions. "This is especially applicable to the ring shadows in the upper third of the lung, where the shoulder joint and spine prevent the taking of lateral views. If these shadows be pneumothoraces bound by adhesions, it will be made plain when the adjacent lung is collapsed." If adhesions hold the entire apex in place the outline of shadow or cavity is frequently altered. Even the successful but incomplete compression of the lung may not collapse an unquestioned cavity on account of the rigidity of the cavity walls. Serial plates after the addition of more and more air show two things that are significant, namely, a lessening of the size of the cavity or alteration of its shape, and a change in location, neither of which would take place if the outline in question were due to adhesions between lung and wall.

X-rays in the Diagnosis of Gastro-Intestinal Diseases in Childhood. H. Martin Berry, M. D., Practitioner, 119:99, July, 1922.

I N CHILDREN the limits of normal variation of shape, size, position and function of the stomach are much wider than in the adult. The normal adult shape is not even approximated until after the second year of life, usually much later, and the stomach lies higher and more transversely in the abdomen

with the pyloric opening directed farther backward.

It is not generally recognized that a bismuth meal examination is valuable for any but the adult patient. This is to be regretted for the examination of the child by this means yields at times very valuable information.

The emptying time cannot be gauged as in adult stomachs; in a normal child food will be seen in the duodenum in a few minutes and usually the greater part will be expelled in from one and one-half to two and one-half hours, though the remainder may linger a long time.

Also, in the child, the mechanism of emptying differs—there are no definite waves of peristalsis as in the adult stomach and the food seems to be expelled by contraction of the stomach as a whole. Decided peristaltic waves in the infant stomach indicate obstruction, just as in adults. Functional ability of the pylorus can be observed and this is of value sometimes in indicating the need of Rammstedt's operation, which has been successfully borne by infants.

Carcinoma of the gastro-intestinal tract in children is very rare, though it has been found. Gastric ulcer is more likely to be found. The author has twice encountered diaphragmatic hernia of the stomach in children.

Many problems of infant feeding may be solved by the sophisticated use of the x-rays. The effect of change of diet on gastric motility may be studied by the addition of a small quantity of bismuth to the food, and the suitability of prescribed diet thus quickly determined. The presence and amount of gas in the digestive system can also be studied by the x-ray.

Diminished nutrition is often due to the distension of the stomach by gas which may have been swallowed (air) or produced by fermentation or by regurgitation. Of course, some gas is normally present. Interesting facts regarding posture in feeding have been brought to light by x-ray study. The erect position is the best for feeding because less air is then introduced into the stomach.

Malposition and adhesions may be distinguished. Enlarged mesenteric glands may simulate gastro-intestinal pathology and can be detected by the x-ray. It is also useful in detecting vesical and renal calculi which may occur in early life.

The four abstracts following are from a symposium delivered at the first Bilingual Congress of Radiology and Physiotherapy, held in London this past spring and proposed to be held annually in France, Belgium or England.

Discussion of the Normal Stomach. Drs. Lebon and Colombier, Paris. Arch. Radiol. & Electroth., 27:34, July, 1922.

THIS DISCUSSION is treated under the headings: The Stomach as Described by the Anatomists; The Radiological Examination; Infant and Adult Stomachs as Revealed by the X-ray.

The author's conclusions are here quoted (translated): The infant stomach with its oblique axis from top to bottom and from left to right resembles the form of a horn which the older anatomists used to state was the form of the adult stomach.

The adult stomach, on the contrary, lies vertically in the abdominal cavity to the left of the median line, and in the majority of cases it has the form of the capital letter J.

The pylorus is situated on the horizontal line passing through the middle disk at the third or fourth lumbar vertebra, and is located, according to the type of normal stomach in which it appears, either to the median line or to one of the two parasternal lines.

The lowest line of a normal stomach does not descend below the line that joins the tips of the two iliac crests, however full the stomach may be. Normal contractions are sluggish in movement, about three per minute, and they begin with the arrival of the food at the lower level of the stomach. A normal stomach does not reveal the presence of food by any sign of pain whatever.

The normal stomach depicted by the x-ray will lie in a plane bounded by the following lines: Above, the diaphragm; below, the ilium; at the left a line passing through the mammary gland; at the right the median line or one of the two parasternals.

The same type of meal should be employed routinely. If the French preparation of "gelobarine" is employed the normal stomach should empty itself in at least two hours and a half.

The Normal X-ray Stomach. M. Peremans, M. D., Antwerp. Arch. Radiol. & Electroth., 27:46, July, 1922.

THE BARIUM filled stomach revealed by screen or plates is in many respects different from the anatomical descriptions found in the texts. However, whether the x-ray stomach is an absolute standard or not is not so important to the radiologist.

Instead of a barium meal the author uses barium milk, which is a French preparation. It is an emulsion of 100 grams of barium sulphate and 100 grams of water with enough paraffin

and agar to give a standing solution: to this 200 grams of water are added before using.

The examination of the patient starts at 9 a. m., and a second examination is made at 1 p. m. Later in the afternoon the examinations are repeated. No food or drink is allowed between the first and the second examinations. Screen examinations are made in the upright position and plates are made thus also. A few hours retention is considered abnormal.

Because of economic reasons the serial plate method is little used. An effort is always made to have the referring physician present at the x-ray examination, but if this is impossible all the clinical and laboratory records are obtained before the x-ray examination is made.

The Abnormal Stomach. Sir A. Reid, K. B. E., C. M. G., Arch. Radiol. & Electroth., 27:52, July, 1922.

ALTHOUGH the ideal examination consists of exhaustive screen examinations supplemented by plates, the author urges that because of the dangers to the roentgenologist, attendant upon frequent screening of patients, the plate examination should be used as much as is consistent with reliable diagnosis. He believes that the serial plate method will in most cases yield all necessary information, but when the screen must be resorted to that the utmost possible protective measures should be employed.

He also believes that it is quite possible to invent an automatic device by which palpation can be accomplished without keeping the hand in the path of the rays. In his own laboratory he is working out a method in which serial examinations are made at intervals of two seconds, making six 4 by 5 inch exposures on a 12 by 10 inch plate. He hopes by improving this method to obtain increased accuracy of detail in the pictures.

Present Day Value of the Opaque Meal Examination in Gastric Lesions. S. Gilbert Scott, M. R. C. S., L. C. R. P., London. Arch. Radiol. & Electroth. 27:58, July, 1922.

THIS WRITER uses a card index for every case. Each item noted upon examination of the patient is entered as is also the ultimate diagnosis, and later checked with the operative findings. He finds this detailed method often leads to improved methods of technique and has a distinct reaction upon progress in his laboratory.

When the x-ray diagnoses are found to be greatly at variance with the operative findings the cause is usually found

to be the impaired vitality of the roentgenologist. A great deal of stress is laid upon the fact that every x-ray laboratory worker should have at least two hours daily in the open air and that one day in the week he should not enter the x-ray laboratory at all. Unless these precautions are heeded in the writer's laboratory the result is decreased accuracy in diagnoses.

The emptying time of the stomach has such wide variations, due to so many causes (as much as four hours difference in the emptying time of the normal stomach can be induced by diet alone) that as a diagnostic sign it has a quite unreliable value.

Screening alone or the serial plate method alone is not a wise procedure in the main. This author believes that it is almost necessary to use both as a routine.

He believes that the time is coming when all gastric lesions may be detected radiologically, that is, their presence will be revealed though the exact diagnosis may not be arrived at for every lesion.

Gastro-Intestinal Roentgenography. Editorial, *Am. J. Surg.* 36:232, September, 1922.

A PROPOS of the incompetent roentgenologists who bring discredit upon the profession, this editorial says: "The patient usually regards the x-ray pictures as photographs of his intestinal tract and is accordingly prepared to accept the report as a finality. So, often, does the physician, especially if it coincides with his own loose diagnosis of 'chronic appendix,' if he is without experience in roentgen diagnosis and is unable to interpret the films, if, indeed, he even sees them. * * * Every surgeon of experience must be convinced that the percentage of cases in which chronic appendicitis can be demonstrated roentgenographically must be small; yet how often the diagnosis is made by some who set themselves up to be roentgenologists. * * * Variations in the shadowed outlines of the esophagus, stomach and intestines demand experience in interpretation. Not all of those who conduct x-ray laboratories are competent to make those interpretations."

The Writing of Medical Papers. Editorial, *Am. J. Surg.* 36:233, September, 1922.

THE WRITER of this editorial says: "Some of us, of course, are quite unable to write well—either because of careless habits of thought and expression or because of lack of training in composition. They may be forgiven and deserve editorial indulgence; many a brilliant university graduate is

a 'poor speller.' Some, however—and they do not deserve forgiveness—do not take the trouble which they should, to revise their articles again and again, until they have eliminated all that is unnecessary and repetitious, and have expressed the remainder in clear, grammatical and well punctuated sentences. Some, indeed, do not go over the final sheets to correct their typewriter's errors. * * * The American Medical Association publishes a pamphlet on Bibliographic Style and Suggestions to Medical Authors (25 cents) that ought to be more generally studied. * * *

In a rather long editorial on 'How to Write a Medical Article' (*Am. J. Surg.*, March, 1921) we, too, pointed out in a spirit of goodnatured satire the common faults in medical composition and the preparation of medical papers." (Note: Reprints of this article are available. It contains vital editorial truths dressed in a form to rival "Life" and "Punch.")

Besides the pamphlets published by the A. M. A., the writer praises very highly a book just out, "The Writing of Medical Papers," a review of which appears in the *Journal* this month.

Carcinoma of the Esophagus with Perforation of the Aorta: Observations on Radium Therapy. James G. Carr, M. D., and C. W. Hartford, M. D., *Am. J. Med. Sci.*, 164:340, September, 1922.

"SINCE the publication of Knaut, in 1896, 21 cases of esophageal carcinoma with perforation of the aorta or other large vessels have been reported. Another case is added here.

"Autopsy findings in the case here reported disclosed certain deficiencies in the application of radium therapy. Suggestions are made for more effective technique.

"Radium therapy of esophageal malignancies has to contend with certain problems as yet unsolved. The disease * * * has often invaded neighboring organs before the symptoms have become sufficiently disturbing to send the patient to a physician. Carcinoma of the esophagus spreads by continuity of tissue; far less often do metastases occur. In the patient apparently improving, with less obstruction, greater ease of swallowing, some gain in weight and strength, symptoms of pulmonary involvement often supervene * * * due to the presence of a secondary mediastinal tumor. To these causes of failure must be added the technical difficulties of the introduction and location of the radium; the diseased area must be sufficiently

dilated to admit the capsule containing radium; emplacement must be controlled by fluoroscopy. It appears from the autopsy * * * that one portion of an esophageal carcinoma may be treated successfully while another portion is missed altogether. * * * Until the tumor, for its entire length, is permeable to a sufficient degree to admit the capsule, so that the capsule may be passed the entire length and redrawn into the area, to be located at different levels, we cannot feel that our technique is directed to the treatment of the accessible growth in its entirety."

Treatment of Diphtheria Carriers with the Roentgen Ray. Dalton Kahn, M. D., *Am. J. Electroth.*, 90:287, September, 1922.

DIPHThERIA carriers ranging in age from seven weeks to 59 years were treated by the roentgen rays with very gratifying results in this preliminary study of 185 cases.

It is not claimed that the action of the rays is bactericidal, but that the shrinkage of tonsils and of lymph tissue establishes drainage which eliminates the infection.

The average time from treatment to release was eight days. Eighteen cases had negative cultures upon the day of admittance, which eliminated them from the study. Thirty-four of the others were released upon negative virulence tests. One hundred and twenty-nine were released upon two or more negative cultures following treatment. A few cases required from three to four treatments; about fifty required two treatments and more than one hundred required only one treatment.

Further Attempts at the Experimental Production of Carcinoma by Means of Radium. W. S. Lazarus-Barlow, M. D., F. R. C. P., *Proc. Roy. Med.*, 15:7 (Sect. Path.) April, 1922.

THE EXPERIMENTS here described are a continuation of those reported in 1918 in the same journal (11:1, Sect. Path.)

In the experiments reported in April, 1922, radium bromide was introduced intraperitoneally into 48 rats. The amounts varied from 0.011 mg. to 0.15 mg. and were inclosed in minute sealed glass tubes. Exposure extended up to 270 days. Ancillary treatment in the form of feeding potassium metaphosphite or exposing to a "suitable dose" of x-rays was carried out before and after introduction of the radium tubes.

Careful postmortem and microscopic examination revealed conditions which could be regarded as possible

criteria of neoplastic growth, but the extent of the change was difficult of interpretation because it was limited—the main mass showed itself either completely degenerated or frankly inflammatory under microscopic examination.

It was concluded from this study, however, that rats are remarkably resistant to induced carcinoma. No criterion was found in 9 animals, one criterion was found in 19, two criteria were found in 17, and three criteria were found in 3.

Malignant Glands and Their Proper Treatment with Radium. C. W. Hanford, M. D., Illinois M. J., 42:214, September, 1922.

MALIGNANCY at the side of the tongue usually metastasizes first to the submaxillary on the same side, then to the sublingual or one of the cervical glands. If the primary lesion of the tongue is at the side, but more toward the back, the lymph glands at the base of the tongue and those near the larynx will be involved early, but in such cases the prognosis is very unfavorable. If the primary growth is at the base of the tongue then the tonsil of that side is usually the first to be involved and next the cervical gland just under the ear.

In epithelium of the lower lip the submaxillary and sublingual glands are first involved and metastasis may extend to the bronchial lymph glands—perhaps even farther.

If the primary growth is in the buccal cavity the submaxillary gland is usually the first to be involved, though the parotid may be invaded at the same time. Metastasis spreads to the cervical chain as far as the supraclavicular region and has been known to reach the mediastinum. Pain in these cases is not very noticeable "until the gland just back of the mastoid attachment of the sterno-clido-mastoid becomes invaded. Then the patient complains of pain in the ear and occipital region."

In cancer of the tonsil the cervical glands are early invaded. Primary cancer of the tongue and buccal cavity may heal while metastases still continue.

In the majority of cases in general, metastasis is on the side of the initial lesion, but this is not always so.

Clinical evidence from the author's own practice leads him to believe that the administration of thyroid extract has considerable effect in strengthening the patient's resistance.

Pre-operative radium treatment is strongly recommended for these lesions.

The Secondary Manifestations of Malignant Disease. Alexander Prim-

rose, C. B., M. B., C. M., Ann. Surg., 76:312, September, 1922.

PALPABLE glands in the axilla in cases of breast tumor are suggestive of but not pathognomic of malignancy. In contrast to this the local lymph glands in carcinoma of the breast may escape infection but distant metastases be present, due to the primary breast lesion. Entire absence of metastatic growth in a case supposedly malignant should arouse suspicion that a wrong diagnosis has been made. This is especially noted with regard to so-called primary carcinoma of the appendix.

"An abscess developing in connection with glandular metastases in cancer may be the first clinical evidence of the disease and the serious nature of the case may be completely masked by it."

In cancer of the rectum the frequent metastases to the lymph glands and to the liver makes an exploratory operation a wise procedure previous to a radical operation or a colostomy.

Implantation of carcinoma upon serous surfaces, especially in the peritoneum, the author regards as a very serious danger—an argument against the two stage operation and for the most careful technique in operation.

Malignancies, especially the sarcomas, are disseminated by the blood stream as well as in other ways.

Bone metastases of cancer is more frequent than used to be believed and the x-ray has proved of very great value in its diagnosis. Since these lesions may be entirely unsuspected by both patient and physician, an x-ray examination should always be made upon complaint of pain in any bony part, especially the spine. "Treatment of these cases by the radiologist may possibly be of some service. It is impossible to make any definite statement in this regard, but certain cases would appear to be relieved of pain and to improve in general health under this treatment."

Recurrence Versus Metastasis in Carcinoma. Ellsworth Eliot, Jr., M. D., Ann. Surg. 76:324, September, 1922.

THE WRITER believes that "the independent development of a second carcinoma without any etiological relation whatever to the original growth which, presumably, was completely and successfully removed" may and does occur, though this cannot be actually proved. Six cases are cited which seem to uphold his opinion upon this subject.

End-Results in Cancer as Influenced by Type, Reaction, Location and Age. Charles H. Mayo, M. D., Ann. Surg. 76:308, September, 1922.

DR. MAYO read this paper before the American Surgical Association, May, 1922. He briefly reviews the subjects of cancer statistics, the hypotheses of its etiology, and the progress made in its pathological study and treatment during the later years.

Dr. Mayo makes the vivid statement that more citizens perish of cancer during one year than our country lost altogether during the great war.

Of roentgen rays and radium he says: "Roentgen ray and radium in the treatment of cancer have made marked progress in a very serious group of cases. When this form of treatment was first undertaken only those whose condition was too far advanced for surgery were considered suitable subjects. * * * Many early and some late cases, according to the location and type, have apparently been cured by such treatment. When vascularity is one of the features of the condition radium is most excellent. The end-result of both roentgen and radium therapy is the development of fibrosis, which often changes the type of malignancy."

Roentgenotherapy of Malignant Neoplasms, Especially Carcinoma. C. Steinthal, M. D., Stuttgart. Muenchen. med. Wehnschr. 69:3, July 28, 1922.

A **CONSERVATIVE** view of the subject of roentgenotherapy of carcinoma is taken. Roentgen treatment of sarcoma, especially the lymphosarcomas, yields better results, although the author states that he does not share the enthusiasm of the Frankfurt Clinic upon this subject. However, present results, disappointing as they are, do hold some promise for the future. In the author's clinic better results have been secured in the treatment of tuberculous glandular lesions than in treating carcinoma or sarcoma.

A British Medical Association Lecture on the Problem of the Radium Therapy of Cancer. Arthur Burrows, M. D., B. M. J., 2:33, July 8, 1922.

THE TECHNICAL difficulties encountered in deep therapy are presented in this paper.

The three conditions upon which destruction of a cancer cell depends "are variable and are made up of variables." These conditions are: A known quantity of rays, the lethal dose of the cells of a certain cancer, and the size and situation of the tumor. Its size, density and depth affect the quantity and quality of the rays penetrating the whole growth. The former difficulty is easily overcome, the latter one only by imbedding radium tubes,

or by varying the distance of the applied radium from the skin, and all tumors are not suitable for this treatment.

The lethal dose for a certain tumor must be established for a definite type of ray and this may have to be changed for a change in position of the growth so slight as only one centimeter in distance.

Rodent ulcer of the skin is easily cured by radium, but rodent ulcer invading bone is a different problem and is rarely cured. Round cell sarcoma, though usually cited as a lesion responding well to radium, does not give as good an end-result as spindle cell sarcoma, although the latter lesion is more difficult to treat.

Large tumors, aside from the difficulty of even radiation, commonly have a poor blood supply at the center and this is an important factor to be taken into consideration in treating these tumors.

When a tumor is of an irregular outline or has varying densities the problem of dosage becomes very complicated.

Not only is the nature of the tumor an important factor in ray treatment, but so also is the nature of the tissue and organs which it invades.

"What is needed is a large number of physical measurements of the different parts of the human body, and of pathological growths, and a full and complete investigation of the nature of the lethal dose for cancer cells; * * * even then it seems that a number of unponderable biological problems such as the resistance of tissues locally to cancer growths remain to be solved * * *

"Seven and one-half per cent of all the cancer cases (mostly inoperable) which came to Manchester for radium treatment are alive and well today after periods varying from two to seven years, and many cases of carcinoma of the uterus, breast, skin, lip, and other regions are in perfect health, which would but for radium be dead; while endothelioma of the parotid gland and spindle-cell sarcoma show still more gratifying results * * * much valuable palliation work is done, while in * * * exophthalmic goiter, Hodgkin's disease (when young), keloid, cavernous and capillary naevi, the percentage of cures is high; finally radium is specific for excessive uterine hemorrhage and spring catarrh."

The End-Results of Operations for Cancer of the Bladder. William E. Lower, M. D., *Ann. Surg.* 76:352, September, 1922.

THIS STUDY of end-results is confined to those from surgical treatment. "The results of recent methods of

treatments by some form of radiation—radium or the x-ray—cannot properly be included at this time, not because we believe this may not be the method of choice in the future, but because sufficient time has not elapsed for the end results to be established."

Simplifying the Diagnosis of Some Kidney and Bladder Diseases by Use of the Cytoscope and X-ray. O. J. Sloan, M. D., *Illinois M. J.*, 42:184, September, 1922.

SOME urological pathology gives no evidence on the x-ray plate. Those which commonly give positive evidence are urinary calculi, deposits of mineral salts in various parts of the urinary tract, and inflammatory calcifications. "Some roentgenologists claim that 15 per cent of calculi in the kidney, 35 per cent in the ureters, and 60 per cent in the gall-bladder cannot be shown by x-ray."

Positive diagnosis of any particular type of pathology from the shadows of a supposedly enlarged kidney must be cautiously rendered for mistakes are easily made here.

The author's conclusions are: "(1) In all cases where symptoms are referable to the urinary tract the combined method of examination with the cytoscope and x-ray is indicated. (2) Urological lesions are frequently diagnosed by the aid of the x-ray when diagnosis is doubtful otherwise. (3) In 50 per cent of urological cases the x-ray shows negative pathological conditions, but with the combined method the diagnosis can usually be made. (4) X-ray findings should in all cases be verified by the urologist before a conclusive diagnosis is given. (5) The combined method is the ideal procedure in the diagnosis of most urological conditions."

The Clinical and Radiographic Dental Aspects of Focal Infection. Clarence J. Grieves, D. D. S., *Dental Cosmos*, 64:29, September, 1922.

RACHITIC, syphilitic and tuberculous bone lesions are recognized by characteristic changes in the hard tissues, but full knowledge of the systemic and local disease, as well as the x-ray picture is necessary for a proper diagnosis. To illustrate, no authority upon the subject would announce that rarefaction, appearing in the bone, is an infected focus because the trabeculae are missing. The radiogram may be taken as significant evidence only if it is confirmed by the pathological and clinical history.

"In the study of oral films, the dependable osseous landmarks which indicate disease are the density and regularity of the lamina dura and the

orderly patterns of associated trabeculae. The generally clear outline of root surfaces, defining periodontal width, as seen in accurate radiograms of normal alveoli, is most important. The condition of all visible parts of the lamina dura must be carefully noted, for it records the amount of bite stress or disease involving the attaching tissues.

"In gingival disease the loss of septal alveolar crests is indicated by the disappearance of the lamina at the gingival borders; if these areas are rarefied with vague trabecular outlines the invasion is deep and the outcome of treatment doubtful; if the rarefied areas are sharp and surrounded by the condensing type of ostitis, and the trabeculae sclerosed, the prognosis is more favorable.

"Pyorrhetic invasion of the molars and bicuspids which approach the antral floor must be explored, for it may produce an obscure antritis. Occasionally deep pockets are hidden by roots superimposed on the film, but generally a close study of all lines in view, representing cemental surfaces, periodontal and laminar regularity, and the character of the trabeculae, will detect the lesion.

"Periapical abscess and proliferating periodontitis, extending all around the apex are always visible in several films from different angles. These must and can be sharply differentiated from regular bone absorption due to traumatizing occlusion, as under bridge abutments.

"In the early stages of acute alveolar abscess, as in other acute bone lesions, the radiogram indicates little; this is also true of freely draining alveolar fistulae. In the subacute and chronic stages, as the granulomatous and cystic types, the radiogram can be more accurately interpreted.

"In diffuse granulating phases of apical disease, the areas are large and the spongial patterns blurred, with little definition; in granulomata and cysts complete rarefaction occurs, surrounded by a line of condensing ostitis. * * *

"The radiograph will not show granulating apical disease on deciduous disease except during the short period when their apices are complete. Before the eruption of the permanent teeth, the whole anterior maxillary region is occupied by the tooth crypts of the permanent crowns and is normally rarefied. A radiographic diagnosis of deciduous apices is thus obviously impossible. Purulent abscesses involve deciduous teeth and may be foci, but it is questionable if the granulating stages, which are said to so actively focal in adults, exist at all in children.

"In the location and removal of impacted teeth the radiograph plays a most important part. * * * Where impaction is associated with gingival disease, invasion of deep third molar crypts by way of the second molar attachments frequently results. These areas must be carefully explored and radiographed, for they may escape observation and cause serious systemic disease."

The Therapy of X-rays in Dentistry.
Erich Knoche, Munich, Dental Cosmos, 64:960, September, 1922.

MORE than 70 cases of chronic periodontitis have been treated by this author during the last three years, with very encouraging results.

Surgical methods give satisfaction, but sometimes are contra-indicated. The author believes that x-ray therapy combines all the advantages of medicinal and surgical methods of treatment and that it has not any of their disadvantages. X-ray therapy for inflammation of the gingival margin and pyorrhea alveolaris is useless as these symptoms disappear as soon as their cause is resolved.

"Through the influence of the radiation a new formation of bone begins at the margin of the seat of the disease, which, according to the extent of the absorption, is filled in a few months with new bone. The progress of the new formation is easily determined by the roentgenogram.

"Fistulas disappear in about a fortnight, clinically, and subjective symptoms disappear in about three weeks. It is better to radiate the alveolar process directly to avoid epilation or pigmentation of the skin.

"Damages from the x-rays, which could not be repaired, have never been seen and ought not to be feared when the proper technique is carried out. Children, however, have been excluded from the treatment, as the youthful epidermis is very sensitive to x-rays."

None but an x-ray specialist should administer the rays for this treatment.

A Laboratory and Clinical Study of the Bactericidal Action of Solutions of Radium Emanation. John Albert Marshall, D. D. S., Phil. D., California State J. Med., 20:8, January, 1922.

DENTAL apical abscesses treated with a radio-active solution form the basis of this report. The experimental work was done by the author to ascertain the therapeutic value of radium emanation used as bactericidal agent in chronic dental apical abscesses.

The work of Lequeux and Chrome, and that of Iridell and Minett is cited

regarding the bactericidal action of radium upon streptococci.

The method used by the author was to crush a capillary tube of radium emanation in a sterilized mortar, previously covering the emanation with Ringer's solution. This radio-active solution was then immediately conveyed to the root canals of the tooth by means of J. and J. sterilized cotton points, which were sealed in the canals for from one to four days. They were then removed, the pulp canals tested for sterility, and filled.

Observations of nearly a year's clinical cases of chronic dental apical abscesses have shown that these lesions yield readily to this treatment with no untoward events to date. There was succeeding soreness and pain in only one case.

Further laboratory data are being sought before final conclusions are drawn from these studies.

Note on the X-ray Diagnosis of Rickets. Hans Wimberger, M. D., Lancet, 203:11, July 1, 1922.

"DIAGNOSIS of rickets by x-ray is based principally upon careful observation of quantitative alterations in calcium content of the bones. This demands frequent photography and must reach a high standard of technique. Changes in the form of the bones are a second diagnostic point when the disease is well established."

The primary calcification zone first loses its homogeneity and appears wider and less well defined. The sharp end-margin of the metaphysis is lost as calcium content is reduced and a fine fringe shows. The terminal part of the bone decalcifies more rapidly at the center than at the periphery, and it will show a coarsened structure due to a replacement of calcified trabeculae by osteoid tissue, perhaps even to a degree that prevents distinction of bone from soft tissues.

Beginning of healing is easily recognized by the appearance of a "new primary calcification zone between the epiphysis and the abnormal (radiographically invisible) tissue found in the metaphysis during the rachitis period."

For about two years after rickets of even a moderate degree the difference in structure between the healed metaphysis and the portion of the diaphysis formed before the onset of the disease will be quite apparent.

"The earliest symptoms appear in the most rapidly growing metaphyses, which also suffer most damage when the disease is prolonged." Examples cited are the sternal ends of the ribs, distal ends of femur, proximal ends of

the humerus, tibia and fibula. The ribs are not suitable for diagnostic plates.

X-ray photographs are the most accurate means of ascertaining measurement of bone growth. The most rapid growth of normal bones is in the spring and early summer and the slowest is from December until March. In rickets retardation of growth appears earlier than in normal infants and often a long period of absolute cessation of growth precedes the disease.

The Etiology of Rickets in Infants.
Drs. Chick, Hume, Mackay, Smith and Wimberger, Lancet, 203:7, July 1, 1922.

INVESTIGATIONS carried out during the last eighteen months at Vienna show that rickets can be cured by cod-liver oil or by exposure to sunlight or to the rays from a mercury vapor quartz lamp. The lamp used was the Hanau pattern and treatment was given three to four times weekly beginning with five minutes exposure at a distance of 80 to 100 cm., the time being gradually increased to thirty minutes and the distance to 60 cm. Full dosage was attained in two to four weeks, according to the age and condition of the patient. Results were radiographically indistinguishable from those secured with cod-liver oil, and healing was apparent in from two to four weeks after a total exposure of two to five hours. Results were the same whether one limb, one side, or the whole body was rayed.

It was found that rickets developed during the winter and spring (under excellent hygienic conditions) in infants receiving a diet of sugar sweetened fresh milk. All milk was from stall-fed cows. In children receiving a diet containing cod-liver oil, more milk and less carbohydrates, rickets did not occur. During the summer months rickets did not develop at all upon either diet.

The first six months of infancy is a period of special susceptibility to the onset of rickets and the disease may develop in an infant whose general condition is good, also improvement and healing may occur independently of improvement in the general condition.

The Thymic Shadow in Infants. I Edward Liss, M. D., Am. Jour. Dis. Child., 24:192, September, 1922.

AN X-RAY examination of 119 new-born infants was made in this study, the plates being made within forty-eight hours after birth. It was planned to make another examination ten days later and monthly after that for two years, but it was not possible to follow up the entire 119. However, a sufficient number were so followed up to make the report worth while,

Forty-two per cent of the children examined within forty-eight hours after birth showed thymic shadows measuring more than three centimeters transversely which in this writer's opinion is a pathological sign.

The conclusions drawn are: "(1) Thymic shadows can easily be determined in the new-born and in infancy. (2) Transversely enlarged shadows are present in a strikingly high percentage of the new-born. (3) This shadow may be present without symptoms or physical stigmata. (4) There is a definite tendency toward a spontaneous retrogression of this shadow during the first year, but some glands persist beyond this period. (5) There is a type of thymic shadow cast by a pedicle-shaped organ, the mass of which lies on the heart, from which it cannot be differentiated. (6) In the later months of infancy the presence of large parabranchial glands and prominent blood vessels presents some difficulty in differential diagnosis, but differentiation is possible."

A Case of Hodgkin's Disease Treated with Roentgen Rays for Six Years. Kenneth R. McAlpin, M. D., and William C. Von Glahn, M. D., Arch. Int. Med. 30:287, September, 1922.

THE PATIENT was a woman 20 years of age. Her chief complaint on admittance to the clinic was pain in the abdomen and a general weakness. There was a burning pain in the left side, radiating to the back. Twenty days after admission a hard, irregular, freely movable mass was felt in the lower right quadrant. The x-ray examination of the abdomen was negative for glands.

An exploratory operation revealed numerous enlarged glands in the mesentery of the hollow viscera, some of these measured five centimeters in diameter, all were yellowish and of a cheesy consistency. The pathologist's report was Hodgkin's disease.

Roentgen ray therapy was begun about three months after the above operation, the second treatment followed a month later. The patient felt better and roentgen ray treatments were given every two weeks for more than three months, when the patient was again admitted to the hospital.

The disease was slowly progressive. There were periods when she was very ill, which were followed by periods of improvement, but the acute stages became longer in their duration and improvement after each one correspondingly less marked. Her temperature was of a recurrent type and her blood pressure was very low from the time of admittance.

"Our patient was treated 95 times with roentgen rays * * * apparently the glands decreased in size, especially the cervical nodes. * * * The number of areas were changed from time to time, but were always so arranged that all the contents of the thorax and abdominal cavity were exposed to the rays. * * * It is safe to say that the roentgenotherapy slowed the process, but in no sense cured the condition."

Roentgen ray and blood transfusions (nine in all) were the only therapeutic measures used, with the exception of sedatives. Radiation was discontinued six months before death because of general weakness and the low blood cell count.

Death was due to a perforation of the intestine. During life the spleen had been thought to be considerably enlarged, but at necropsy it was found only slightly so. The unusual pathological findings were extensive involvement of the peritoneum and abdominal viscera, a tendency to regional invasiveness, atypical giant cells and a scarcity of eosinophiles.

Clinical Types of Goiter and Their Management. Charles A. Elliott, M. D., Med. Clin. N. A., 5:1623, May, 1922.

THIS AUTHOR says: "We have not observed the definite and lasting results which would stamp these agents as all sufficient in the treatment of hyperthyroidism," but it is stated that perhaps these agents have not been perfectly applied.

"In general it must be admitted that radium and x-ray may be sufficient in any given case and that they are useful in reducing hyperthyroidism preliminary to operative interference." In selected cases of toxic goiter radium or x-rays may be indicated and in exophthalmic goiter they may be advisable preliminary to a subtotal thyroidectomy.

The Treatment of Cancer of the Jaws. Albert J. Ochsner, M. D., Ann. Surg. 76:328, September, 1922.

DR. OCHSNER since 1901 has operated 126 cases of malignant tumors of the jaw. The last 26 of these have been added during the past four years and the first 100 were reported upon four years ago.

The tumors in these cases have been removed by the cautery and this operation has been followed by intensive x-ray treatments. Besides these operable cases, many inoperable ones have been given palliative x-ray treatment.

"So much progress has been made

in the use of x-ray and radium that in the next few years there may develop marked changes in the treatment of these cases. * * * Our observation has convinced us that early and very extensive operation with the cautery, followed by carefully planned after-treatment with x-rays or radium, is quite worth while in these cases and that occasionally even advanced cases will be permanently cured by this method."

Endothelioma of the Dura. Charles Louis Mix, M. D., Med. Clin. N. A., 5:1673, May, 1922.

THIS is an account of a case of Pott's puffy tumor. Frequent forenoon headaches and occasional "stopping up" of the head were at first the only symptoms. The roentgenologist's report was negative, and this, plus symptoms, led to a diagnosis of sinus infection. However, treatment gave no relief and the patient came under the writer's observation September 21, 1921. The roentgen findings were again pronounced negative, but the physical findings revealed a slight puffiness of the scalp in the left occipital region. This was accompanied by a higher degree of temperature than was the surrounding area.

Upon operation the scalp was found somewhat edematous in this area and the bone area directly beneath was found diseased. Trephining revealed diseased bone clear through to the underlying dura, which was firmly adherent to the brain tissue. Dura, arachno-pia and cortex were grown together in an indistinguishable mass. This mass was cut away. Strands of endotheliomatous cells extended down along the blood vessels as far as the section of brain removed.

The wound healed slowly. A resultant hemonymous hemianopia is attributed to the operation having involved the higher visual cortex. This suggests "that the exterior occipital cortex is as much a center of ultimate sight as the cuneus on the mesial aspect of the occipital lobe." Occasional slight headaches still appear.

Postoperative x-ray treatments are regarded as very important in this case and intensive treatments were given monthly until January and since that time have been given at intervals of two months.

Re-examination of the roentgen plates taken before operation showed that the x-ray had revealed the area of diseased bone, as a slight disturbance, but the attention of the roentgenologist had been centered on the supposed sinus infection and the shadow had passed unnoticed.

The End-Results of Treatment in Certain Forms of Malignancy of the Neck. Martin B. Tinker, M. D., *Ann. Surg.* 76:335, September, 1922.

THE DATA for this study were collected from 38 surgeons.

The author classifies malignancies of the neck into three groups, which, with the treatment recommended, are as follows: (1) Operation contra-indicated in metastases to the neck from tonsillar or pharyngeal growths or those of unknown origin. Radium or x-ray should be used for the tonsillar and pharyngeal malignancies. (2) Operation offers a reasonable chance of recovery in early cases of malignancy of the thyroid, malignancy originating in bronchial cleft remnants, carotid gland tumors and those of the parotid, also in early cases of Hodgkin's disease. (3) Operation offers little hope in advanced cases of Hodgkin's disease, advanced thyroid malignancy and advanced branchial cleft carcinoma. Radium or roentgen rays with or without surgery is advised for these cases. Palliation is assured and occasionally there follows an apparent permanent cure.

A Case of Pneumothorax Following Breathing Exercises. James Crockett, M. D., *Lancet*, 203:330, August, 1922.

THE PATIENT in this case, an active and athletic young man, upon going through his daily breathing exercises one morning felt a sharp pain in his chest and became breathless. This passed, however, and after breakfast he took a forty-five mile run on his motorcycle, but became very ill upon reaching his destination.

An x-ray picture revealed the lung completely compressed against the mediastinum with a band of adhesions stretching from the lower mediastinum to the axillary area. The adhesions would seem to indicate that at some remote time there was present an active tuberculous lesion of the lung, although no history of such a lesion could be elicited.

The patient's temperature has been normal from the first, but his pulse rate was ninety. The pulse rate has become normal and the lung is slowly expanding at the present time.

Grundriss der gesamten Roentgendiagnostik innerer Krankheiten fuer Aerzte und Studierende. By Fritz Munk, Lecturer in the University of Berlin. 292 pages; 193 illustrations. Second edition, 1922. Published by George Thieme.

IN THIS comparatively small book the author has carried out the purpose, avowed in his preface, of presenting some of the essential facts of roentgenologic diagnosis for the benefit of students and physicians who do not intend to practice roentgenology as a specialty.

There are chapters on technique, on the examination of the heart, lungs, stomach and abdominal organs, urinary apparatus and bones. Except for references to Cannon and Skinner only German references are mentioned in the bibliography. The illustrations are small and not conspicuous for their excellence. Chapters on the heart and lungs are of about equal length, and take up almost half the book.

To roentgenologists the book is bound to be disappointing, but the author expressly disclaims any intention of writing for their instruction. To clinicians it cannot fail to be of some value, for it sets forth more than most of them know concerning roentgenology.

And this brings up the perennial question of how to obtain maximum service from the x-ray. The work of a well trained roentgenologist is undoubtedly superior, but he is not always available. Thus, the essence of the question is whether the clinician employing the x-ray himself adds to his correct diagnoses or increases his mistakes. At all events, if he is obliged to use the roentgen ray he should acquaint himself not only with the striking phenomena, which are easily recognized, but also with the numerous diagnostic pitfalls which are far less easily learned.

There is no royal road to roentgenology.

R. D. C.

The Writing of Medical Papers. By Maud H. Mellish, Editor of the Mayo Clinic Publications. 16 mo. 146 pp. and index. Philadelphia and London, W. B. Saunders Co., 1922. Cloth, \$1.50 net.

THIS AUTHOR has written a little book which will prove a useful servant to nearly every medical writer who may chance to employ it.

There are multitudinous technical points necessary to proper literary form, which, although taught in both high school and college, have never been learned by the average graduate of an American college or university. The first 65 pages of this book deal with just these technicalities which often perplex writers, and, if not observed, at times confound their readers.

It may be too much to expect that every medical writer will set himself to the task of acquiring a better knowledge of these points, much as his literary style would profit thereby; some men are too busy, some are too careless, and some are entirely unaware of their literary sins and short comings. The responsibility for their manuscripts appearing in the correct form must, therefore, depend upon the editors of these, and to these workers the first section of Mrs. Mellish's book will be particularly welcome and helpful. These same individuals will add fervent amens to the chapters in the second section, which deals with such subjects as the outline, length and arrangement of papers, their construction, the manuscript, bibliographies, etc. The contents of this section are in such readable form that even the busiest man can quickly peruse them and profit thereby far out of proportion to the time so spent.

The author has well fulfilled her avowed purpose of providing a hand book especially adapted to the needs of medical writers and those who assist in the publication of medical literature. It includes, as she says, "the essential points to be found in general text books" and these are illuminated in many instances by telling quotations. To the initiated it is quite plain that much time, thought, study and experience has entered into the making of this little book; no one inexperienced in such work as that of this author could so well assemble the essentials for the mastery of what she calls "the craft of writing."

There are minor points here and there concerning which there may be a legitimate difference in tastes and opinions, but these are minor points and very few, and cannot be avoided in a publication of this kind.

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Radiotherapy in Carcinoma of the Larynx---With Special Reference to Radium Needles Through the Thyrohyoid Membrane*

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RADIO THERAPY in carcinoma of the larynx is not new. Individual cases have been recorded here and there through literature, and some brilliant results have been obtained. Janeway, Barringer and Failla report in their book in 1917, on twenty-seven cases of cancer of the larynx. Of these a clinically complete retrogression was obtained in four, but three patients died later from a recurrence. One was still alive, but was being treated for a small recurrence, which was yielding at the time of making the report. The radium was applied by capsules introduced into the larynx and by radium plaques externally applied. These workers say there can be no question that these results do not represent what should be accomplished in the treatment of cancer of the larynx by radium. As judged by the effects of radium on similar growths situated elsewhere, it is a form of cancer which is usually discovered early enough to yield to radium. The great difficulty concerns the accuracy of application. The majority of these cases have been treated by the insertion of single radium tubes within the larynx, retaining them in place by the little barbed hook. A few of the earlier cases had been treated by the insertion of single tubes on the end of long wires, which were held between the teeth, and a few cases had also been treated entirely by external application. More recently they have been using the three millimeter platinum tube and making direct application of the radium to cancer in the larynx.

In intrinsic cancer of the larynx, several of the three millimeter tubes enclosed end to end in a small sized rubber tube may be passed into the larynx.

If the position of the rubber tube is marked by a ligature the whole series can be withdrawn until this tube is just above the carcinomatous area, which will now be in contact with one or more radium tubes. They say that such a method is far more exact than the use of single tubes, which are difficult to place at the exact desired level on inserting into the larynx.

Having very nearly lost one case from edema of the larynx they very properly say that the greatest care should be exercised in attempting to treat a patient with carcinoma of the larynx without a preliminary tracheotomy. If the case is early, it is possible to do so without danger, though even in such a patient the dose should be very carefully adjusted. If, however, the lesion surrounds a large part of the laryngeal cavity, there will be an additional constriction of the laryngeal cavity produced by the swelling and edema following the treatment. A preliminary tracheotomy need not be done in the early cases. They state that this method of application is not applicable with advantage to cancer beginning in the pyriform sinus or cancer of the epiglottis. In cancer of these locations it is wiser to insert individual tubes, making use of the barbed hooks to retain them in place. By this means, in two cases of cancer of the epiglottis, they have obtained a total clinical retrogression.

Barajas says that spreading epithelial tumors undergo a process of amelioration even to an apparent cure. The radium should be placed in situ, using the gamma rays, and avoiding the stimulant action of the secondary rays. He says that not less than 45 to 60 milligrams nor more than 75 to 80 milligrams should be used. A maximum duration of two hours should be used at each session. These applications should be as frequent as the re-

action of the organism after treatment will permit.

Cottenot reports a case of cure by x-rays of a spindle cell epithelioma of the larynx in a man of 58, who had a tumor of the larynx, which was later shown by biopsy to have been a spindle cell epithelioma. The tumor was so advanced that laryngectomy was advised, but x-ray treatment was decided upon. To preclude edema, a preliminary tracheotomy was done. From January the 11th to the 17th six x-ray treatments were given on succeeding days. Penetrating rays were used, filtered through 8 mm. of aluminum. The total dosage for the six days was 44 H. There was no skin reaction, nor was there edema of the larynx. A second series of irradiations was given from February 9th to the 15th, 44 H. being given in that time. There was quite an edema this time. On February 22nd there was no trace of tumor or infiltration. The patient was seen every week and on March 15th extubation seemed justified, but, as such a rapid and complete recovery was totally unexpected, a final series of treatments of 15 H., from March 18th to the 20th was given. On April 5th, the tube was removed and the larynx was apparently perfectly normal. The patient had gained five kilograms in weight during the course of treatment.

Alexander reports the disappearance of a squamous cell carcinoma of the larynx, under the influence of intrapharyngeal introduction of 50 mg. of radium sulphate, filtered through 0.2 mm. silver, plus 0.5 mm. brass. Applications were made at intervals of five weeks, ten times in all, for twenty to forty-five minutes at each application, after local anesthesia had been applied. The roentgen rays were applied externally.

Hickey has treated successfully a recurrent benign papilloma of the

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, Mo., May 19, 1922.

larynx, by introducing a catheter through the tracheotomy wound from below and attaching radium by means of a string, which would hold the radium firmly in any position by control from the string above and from one through the tracheotomy tube. He then applied the same treatment in a carcinoma of the larynx. The result of the treatment of the carcinoma of the larynx was not reported. This method of treatment, as suggested by Hickey, is another method of making an application in an otherwise difficult position.

Radium will accomplish best results when it can be applied directly in the tumor tissue. With the exception of the method used by Hickey it is difficult to introduce radium into the larynx and keep it in position for any length of time, especially in an advanced case.

In association with Dr. George B. Wood we have tried to introduce radium into the larynx by means of an intubation tube, but not with great success.

Direct application of radium into carcinoma of the larynx may be made by four different methods: (1) One may insert into the diseased tissue by direct laryngoscopy emanation "seeds" and allow them to remain in place until they are imbedded by fibrous tissue, coughed up, or inhaled. If the carcinoma is ulcerated and friable such seeds may drop or be inhaled into the lung and produce local necrosis or abscess of the lung. They could probably only be introduced into the upper surface of the tumor. (2) Needles containing radium element can be introduced in a similar manner, and, attached to a strong thread, can be prevented from dropping into the lung, but when the diseased tissue is friable it is extremely difficult to make these needles retain their place and not return with the needle holder. (3) One can do a laryngotomy and apply the radium by emanation "seeds" or radium element needles inserted into the diseased tissue under direct vision. (4) One may insert the radium element needles through the thyrohyoid membrane into the diseased tissue, on either side or on both sides.

INSERTION OF RADIUM ELEMENT NEEDLES THROUGH THE THYROID

Believing that the insertion of radium needles through the thyrohyoid membrane was possible, I first discussed it with Dr. Chevalier Jackson, who also believed it to be practical. I then did this on the cadaver in association with Dr. Robert Hunter. We found that the needles could be placed as desired; the chief requirement being a knowledge of the anatomy and of the location of the cancer.

The patient should have a tracheotomy done before attempting the introduction of the radium needles, because the edema and congestion resulting from the application of the radium might otherwise lead to strangulation, or, at least, to a hasty and inconvenient tracheotomy. If there is not much stenosis, the tracheotomy may be delayed until the preliminary roentgen ray treatment has been given.

External radiation should be given, I believe, by means of the roentgen rays to partially devitalize the primary cancer cells and any metastatic lymph nodes which may be present. This will make the puncture of the neoplasm less dangerous. The preliminary radiation will require one or two weeks, and it may be an advantage to continue the external applications until the tumor tissue has decreased to a standstill. This latter procedure was followed in cases No. 3 and No. 4. In about a week after the tracheotomy has been performed the patient will likely be ready for the introduction of the radium needles. The radium needles should be thoroughly sterilized and attached to sterile thread, or better to sterile copper ligature wire. The needles can be sterilized by being suspended in boiling water. The patient is given a general anesthetic. The skin is cleansed thoroughly by means of alcohol. I believe that iodine is contra-indicated, because of the likelihood of producing a dermatitis, when associated with radiation. If the disease involves only one side of the larynx, I believe the needles can be confined in this treatment to the affected side. If both sides of the larynx are involved, the needles can be inserted on both sides. On the side, on which one proposes to insert the radium needles, the larynx is crowded as far as possible toward the affected side. Granting that the disease extends downward along the affected side, one then introduces the needles as nearly vertically as possible and as nearly confined to the central portion of the disease as is possible. Ten milligram needles can be inserted approximately one centimeter apart and left in place four to six hours. This will cause considerable reaction and probably edema, but if the patient already has a tracheotomy tube in place, there is comparatively little discomfort. If the disease has not completely disappeared at the end of six weeks the treatment may be repeated so far as is necessary. Within two or three weeks after the introduction of these radium needles, if there are any metastatic lymph nodes present, the radium needles may be introduced into the lymph nodes and x-ray treatment can be applied over the general area of the neck involved.

CASE REPORTS

Case No. 1. Mr. P. McL., age 56, was referred to me on May 10, 1920, by Dr. P. F. Moylan for treatment of an ulcerated carcinoma of the larynx with metastasis, noticed October, 1918, or two years and seven months before being referred to me for treatment. He had been treated for five months by Dr. Moylan by local applications, and during six months he had had an enlarged lymph node, which the patient himself noticed, to the right of the neck, on a level with the larynx. Smears made from the throat and examined by Dr. Kolmer for tubercle bacilli were negative. A Wassermann test was also negative. His condition was getting rapidly worse and at the time he was referred for treatment, he was not able to eat anything, excepting soft food and soup. Phonation was painful. He suffered from dysphagia. He had a hoarse persistent cough. He had lost 30 pounds. His appetite was poor. The entire upper portion of the larynx was filled by an ulcerating carcinoma, which had destroyed about half of the epiglottis. The lymph nodes on the right side of the neck measured 4 by 3 by 3 cm. The patient was emaciated and cachectic. X-ray examination showed enlarged upper mediastinal glands, the nature of which could not be determined.

A preliminary course of x-ray treatment was given through 21 portals of entry, covering the entire neck from every angle, as well as the upper portion of the chest, introducing the radiation from all directions toward the upper mediastinum. All of this x-ray treatment was given during a period of five days. The patient then had a tracheotomy performed by Dr. Thomas J. Byrne.

One week after the tracheotomy was done, and two weeks after the beginning of x-ray treatment, the patient was given nitrous oxide gas through the tracheotomy tube. Before any radium needles were introduced, the patient coughed much pus from the tracheotomy tube, which indicated that the purulent material from the upper portion of the larynx had extended downward into the lungs. Under gas anesthesia, eight radium platinum needles, each containing 12½ mg. of radium element, were introduced obliquely downward through the thyrohyoid membrane on the right side and left in place for four hours. Then two were introduced anteriorly upward, one on the left side upward, and five others obliquely downward into the larynx on the left side, and allowed to remain in place four hours. Then four needles were introduced into the metastatic lymph glands on the right side of the larynx and left in place for

ten hours. At the end of this time the patient was in fairly good condition.

On June 21, 1921, or approximately four weeks after the introduction of the radium needles, Dr. Byrne made the following report: "Cancerous growth anteriorly and laterally has almost entirely disappeared. No area of erosion whatever. Posteriorly we have some vertical points sticking directly upward, the sole remains of the cancer invasion. The nodule on the right side of the neck has been reduced to about half." This report was made to Dr. Moylan. Dr. Byrne reported also that "at a previous examination, the whole latter portions of the larynx were involved by an intrinsic cancer. To this was added a very great destruction of the epiglottis, more marked centrally and along the free border. This morning I had my curiosity satisfied by a second examination of the larynx. At the preliminary examination, a view of the cords was impossible. Today it was comparatively easy to see them during tranquil breathing and phonation, which revealed that the left cord was in its rightly fixed position."

The patient had no further treatment after May 24, 1920, at which time the radium needles had been introduced. On July 14, 1920, Dr. Byrne reported: "An examination of his larynx reveals further progress in the destruction of his malignant condition. The remains of the growth described in a previous report show the elevation with a smaller base, that, of course, makes them relatively sharper in appearance. The sharp processes, over the left arytenoid are of a bluish tint, and it would seem that the ultimate effect of your recent radium treatment has not reduced this particular focus of the disease. There is less disease present in the larynx than was present at a previous examination, and there is no evidence of ulceration." During August the patient regained his general good health and seemed in every way to be well, but on August 15, 1920, the patient died suddenly from heat prostration, according to the opinion of Dr. P. F. Moylan.

Remarks: This was the first patient in whom I tried to introduce the radium needles directly into the diseased tissue through the thyrohyoid membrane. The carcinoma itself was so badly ulcerated that it would have been utterly impossible to introduce and keep in place the radium needles by direct laryngoscopy. The tissues were too friable, the ulceration was too great, and the infection probably would have been carried into the lung tissue to a greater extent than was already there, as indicated by the purulent expectoration. Part of the epiglottis had been destroyed. A more

severe test of the method could probably not have been chosen, because we began with an emaciated, cachectic patient, with infected lungs and local ulceration, and with metastasis. In spite of these difficulties, he apparently recovered. His sudden death by heat prostration must be regarded almost as an accident.

Case No. 2: Mr. H. S., age 66, referred on August 10, 1920, by Dr. W. D. Allebach and Dr. Spencer Kauffman. Eight months previously he had noticed difficulty in swallowing and slight deafness. During the preceding two weeks both symptoms became much exaggerated. He had lost 33 pounds in weight within six months. He had a large mass about five centimeters in diameter, filling the pharynx and apparently projecting from the larynx. Dr. Kauffman had made the diagnosis of epithelioma of the epiglottis.

Preliminary x-ray treatment was given externally and surface applications of radium were made to the tumor in the larynx. On August 17, 1920, or one week after beginning treatment, 100 milligrams of radium element, in eight needles, were introduced into the diseased area through both sides of the neck, and left in place for seven hours. This seemed to produce a marked congestion and strangulation developed. An emergency tracheotomy was done by Dr. George Coates. Following this application of radium the tumor rapidly decreased in size, and at the end of two months all evidence of the tumor had disappeared. The tracheotomy tube was then removed. Another course of x-ray treatment, however, was given on either side of the neck.

The following radium treatment was given in all: August 17, 1920, 100 mg. of radium in needles inserted into the tissues of the neck at the top of the larynx, on August 31, 1920, 100 mg. inserted into the base of the tongue. September 10, 1920, 50 mg. in 1 mm. of gold and 1 mm. of rubber was applied for two hours at the base of the tongue and repeated again on September 17th and 20th. On September 30, 1920, 120 mg. of radium in the form of needles was inserted about the base of the tongue, and in the left submaxillary region, and the right submaxillary region. On May 24, 1921, there was some thickening of the tissues, over an area about one centimeter in diameter, beneath the left angle of the jaw. We were uncertain as to whether it was part of the original disease or fibrous tissue, secondary to radiation. We, therefore, inserted 40 mg. of radium in four needles directly into this thickened area. There has been nothing to suggest disease since that time. The patient is, therefore, alive and well; almost two years after this extensive

disease, from which he had good reason to die.

Case No. 3: Mr. Geo. E., age 48, was referred for treatment on June 20, 1921, by Dr. M. S. Ersner. About nine years before this date he began to have hoarseness. In 1919 he developed influenza and then began to have pains in the head, ringing in the ears, and pains in the chest, with loss of weight, and for a year past had not been able to talk above a whisper. He had had an attack of a smothering sensation and two weeks before he was referred for radiation treatment, on account of danger of asphyxiation, a tracheotomy had been performed by Dr. Ersner.

Dr. Ersner sent with the patient the following description: "Pediculated mass as large as a walnut is attached to the right vocal cord. The right vocal with thickening of the ventricular band, associated with a great deal of destruction. There is only slight destruction on the left side of the larynx." tion on the left side of the larynx."

Using a 9 inch spark gap and 5 ma. current, with 6 mm. of aluminum filter and 40 cm. distance, we gave a 25 minute exposure daily for four days, alternating from right to left side, so that within a week he received two of these doses, one on each side of the neck. The treatment was begun June 21, 1921, and he was treated June 21, 22, 23 and 24th. A second course of treatment at 30 cm. distance, with twenty minutes exposure was given on July 14, 16, 18 and 19th. A third course of treatment was given August 2, 16, 17 and 22nd.

He showed immediate improvement from beginning of treatment, and on August 2nd was discharged from the hospital. His voice had increased from a whisper to normal tone. The growth at this time had diminished 60 per cent, according to the estimate of Dr. Ersner. He had gained ten pounds in weight. He was active, alert and looked like a new man. His voice was strong and his color healthy. Dr. Ersner regarded the result as miraculous. The tracheotomy tube had been removed and the wound completely healed.

On September 20, 1921, Dr. Ersner reported as follows: "Patient has infiltration on the right side of the larynx the size of a peanut, involving the ventricular band and cord. He has sufficient breathing space and most likely can stand radium." Dr. Ersner suggested, however, that he should be kept in the house while he was being treated with radium, so that we could insert the tube if we deemed it necessary. On October 3, 1921, before the Pennsylvania State Medical Society, five 10 mg. radium

needles were introduced into the tumor through the right thyrohyoid membrane. They remained in place eight hours.

On October 20, 1921, Dr. Eiersner reported that the tumor mass had decreased 100 per cent since his previous examination, which was before the radium treatment. Both his cords were now distinctly visible. On October 18, 1921, he was exhibited before the American College of Surgeons, at which time there was no evidence of disease. On January 16, 1922, he had slight hoarseness, but felt well and looked well. This patient continues well and is working daily.

Remarks: This patient was suffering from advanced carcinoma, required a tracheotomy to prevent him from strangulation, and under x-ray treatment the tumor nearly disappeared, but finally reached a standstill, and further progress was not made until radium needles were imbedded into the tumor mass, through the thyrohyoid membrane. This, seemingly, has removed the remainder of the disease. He is still kept under observation.

Case No. 4: Mr. H. M., age 64, was referred March 28, 1922, by Dr. Lewis Fisher for treatment by radiation, for carcinoma of the larynx. He had been hoarse for several years, growing progressively worse, with more hoarseness and dyspnea, and he had difficulty in swallowing. Ten days previously his condition had become so bad that Dr. Fisher had been called upon to do a tracheotomy. Dr. Fisher reported as follows: "Mr. M. has a large movable mass in the anterior commissure of the larynx, attached by a broad base to the left vocal cord. There is also a smaller mass on the right cord. The mobility of the arytenoids is considerably impaired. I cannot make out any extra laryngeal involvement."

He was given four applications of the x-rays on each side of the larynx between March 21st and April 21, 1922, with a 9 inch gap, 5 ma., at 40 cm. distance, and forty minutes exposure at each seance.

On May 2, 1922, under gas anesthesia, we introduced ten needles, each containing 10 mg. of radium element, through the thyrohyoid membrane, five on each side, directing the needles downward and into the tumor tissue. They were removed in seven hours. Within twenty-four hours he left the hospital, and within forty-eight hours he reported to my office for observation.

It is, of course, too early to form any opinion as to the immediate effects. It does seem to indicate that the procedure is feasible. Later the method may be abandoned, either because the end results are not satisfactory, or be-

cause a better method of application may be found.

Case No. 5: Mr. W. B. F., age 69, referred on May 20th, 1914, by Dr. Wm. H. Teller and Dr. Arthur W. Watson, for treatment of a growth in the larynx just beneath the left vocal cord. Dr. Watson regarded this as an adenocarcinoma. The patient had been troubled with his throat for three months and complained of pain, uncomfortable sensation, some difficulty in swallowing, and at times an interference with his voice, so much so as to make it difficult for him to make himself plainly heard. On May 21, 1914, he was given 13 erythema doses through 4 mm. of filter, and directed through 13 different portals of entry, crossfiring as much as possible upon the larynx. On May 22nd he was given 12 full doses through 12 additional portals of entry. On June 10, 1914, Dr. Watson reported that this heavy treatment had set up considerable reaction, with edema of the arytenoids. The edema was greatest on the right side. On June 11, 1914, 14 additional doses, similar to the previous ones, were given through the right side of the neck; and on June 13th, 12 doses were given through the left side of the neck. On August 1, 1914, 21 treatments were given through 21 portals of entry, crossfiring as much as possible upon the larynx. This was his last treatment and was followed apparently by complete recovery. On July 14, 1919, or five years later, Dr. Teller reported that the patient was entirely well.

Remarks: This patient was well at least five years after a diagnosis of adenocarcinoma of the larynx was made. Since he has recovered there has been some doubt in our minds as to whether this was carcinoma. Wassermann test was negative. Even if this was not carcinoma, but a benign papilloma, we can certainly feel gratified at the result that has been obtained, for it will be a great satisfaction to realize that a benign papilloma of the larynx can be controlled by radiation. In this connection I may refer to two cases of laryngeal papillomata in children that were reported by Dr. Alfred Gray before the American Rhinological and Laryngological Society, Richmond, Va., February 12 and 13, 1909.

In May, 1919, Dr. Gray made a report on three additional cases, and, by correspondence, he tells me that he has added two more cases of adults successfully treated by the roentgen rays. He says: "I feel fully justified in recommending that the roentgen rays be applied in all cases of simple papillomatous vegetations of the larynx and

I believe that benefit or complete cure may be confidently expected."

Case No. 6: Mr. E. S., age 55, was referred to me for treatment of carcinoma of the larynx on July 10, 1919, by Dr. J. Leslie Davis. During eight weeks the voice of this patient had gradually faded away, and at the time of beginning treatment he could only speak slightly above a whisper. His general health had remained good. Wassermann test was negative. Dr. Davis found the left vocal cord fixed, with a tumor protruding between the true and false vocal cords. The right cord was freely moveable and worked normally. Wassermann test was negative and all possible interference with the left recurrent laryngeal was eliminated by x-ray examination. During July 10th, 12th, 14th and 16th, this patient was given 12 erythema doses of x-rays, through 12 different portals of entry, crossfiring, as much as possible, upon the larynx. On August 7th, 8th, 9th and 11th, this treatment was repeated. On August 7, 1919 Dr. Davis reported as follows: "Gratified to find voice clearer and general condition greatly improved. The local condition of the larynx shows a complete change for the better. The tumor is still visible, very slightly protruding, with puffiness of the left ventricle of the larynx, but the left vocal cord shows at least a slight excursive movement on phonation."

The patient was given a third series of 12 doses, crossfiring upon the larynx, on September 11, 12 and 13th. On October 3, 1919, he was examined by Dr. Davis and found to be practically well. No further treatment was given. On February 25, 1922, the patient wrote: "I am feeling very good and have had no other treatment for my larynx since last you treated me. I have gone back to my normal weight, 160 pounds. I was around 130 at the time of treatment."

Case No. 7: Mr. H. G., age 48, was referred for treatment of carcinoma of the larynx on March 14, 1917, by Dr. Menah. He had had throat trouble for one year, first complaining of hoarseness, and this hoarseness grew progressively worse. He did not consult a physician until September, 1916. The throat was treated locally. For three days before x-ray treatment the patient had marked dyspnea, which was so severe that he was unable to lie down at night.

Sputum examination by Dr. Warren Batroff was negative for tubercle bacilli. A Wassermann test made by Dr. Small resulted in a pronounced negative reaction. Dr. Menah reported "Lower portion of larynx is involved on both sides. There is in-

filtration of the mucous and sub-mucous tissues. The vocal cords are swollen and contain vegetation-like growths, dirty gray in color. It is malignant without a doubt."

X-ray examination made on March 23, 1917, showed a mass which filled the larynx and projected below. On March 28, 1917, ten portals of entry were outlined on the neck and four on the chest, and four doses were given directed through the larynx, each consisting of a 9 inch parallel spark gap, 50 ma. minutes, 8 inch distance, 6 mm. of aluminum. Within twenty-four hours dyspnea became so marked that the patient was threatened with suffocation by laryngeal obstruction. It was necessary for Dr. Menah to do an immediate tracheotomy at night, in order to save the patient's life. On April 2, 3 and 25th, two additional doses were given through other portals of entry. Because of a misunderstanding, the patient did not return for further treatment until June 16, 1917, or approximately two months later. At that time he looked perfectly well, and was working every day as a stationary engineer. His voice was still husky, but he could speak and make himself understood. On June 16, 18, 19 and 20th a second series of 13 doses was given, crossfiring upon the larynx. On July 24, 25 and 26th, a third series of 12 doses was given through 12 different portals of entry; and a fourth series was given August 29, 30 and 31st, consisting of 12 doses.

On October 10, 1917, the patient looked well. His voice was returning; the tracheotomy tube was closed with a plug, and the malignant disease seemed to be under control. The patient was working daily. On December 8, 1917, Dr. Menah reported from his laryngeal examination as follows: "The swelling on the vocal cord has diminished very much, so that it is possible to see the true cords. The arytenoids are not much swollen and move nearly normally. The vegetation on the true cord has disappeared."

He was given a fourth series in October, a fifth series in November, 1917, a sixth series in December, 1917. On April 23, the patient returned after having been working in a laundry, and looked well. He had some cough which he called a cold. His voice was hoarse, but he could be distinctly understood.

Under date of April 23, 1918, Dr. Menah reported the patient's condition as follows: "Edema of the false vocal cords, and interior of the larynx, also of the arytenoid. The epiglottis is in very good shape. Two cords are now visible."

On May 25, 1918, the patient reported with the tracheotomy tube removed; the wound closed, and the patient was in good general condition. He still had a dry brassy cough, and he still had some hoarseness. At that time Dr. Menah reported as follows: "The patient is in very good shape. The arytenoids are still somewhat enlarged. The true cords are still somewhat congested, but as far as malignancy goes, I think you can make this the last treatment."

The patient continued in good health for another year and continued his work. He did not report in the meantime for observation. He then returned with an extensive recurrent carcinoma, from which he died. However, from a hopeless and strangulating condition, due to carcinoma of the larynx he was given, at least, two years of life and a reasonable amount of comfort by the exposure to the x-rays alone.

Sixteen additional cases have been treated by the roentgen rays. All have shown some temporary improvement. Two showed temporary recovery, but all ultimately died of the disease. As a result of these observations, I believe that we may draw the following conclusions.

(1) Unless the patient is treated very early and before there are obstructive symptoms, it is desirable to do a tracheotomy before beginning treatment.

(2) The roentgen rays applied externally, alone, justify the hope, even in advanced cases, of temporary recovery, or at least partial relief of symptoms.

(3) The insertion of radium needles through the thyrohyoid membrane into the diseased tissue is practical, and the results so far obtained seem to justify further trial.

(4) These patients should be kept under close observation for several years, for the results of this treatment, as well as that recorded by others show a marked tendency to recurrence. Each case must be judged by itself and the treatment directed to the condition present.

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DISCUSSION ON PAPERS OF DRs. SITTENFIELD, BECK AND PFAHLER

DR. E. H. SKINNER, *Kansas City*: There are so many things that attracted my attention as I listened to these papers that I cannot recall them all, and quite naturally the last paper is more in mind. It struck me at the time Dr. Pfahler was reading that we might take it as more or less of an axiom that in the use of radium in any tubular organ it is very necessary to provide that patient with an exit, from a tubular origin below the lesion, before starting the treatment. As Dr. Pfahler said, we must have a tracheotomy done before starting the treatment so that the patient will live through it.

It is quite as necessary in the intestine to have a colostomy in the beginning, no matter how small the lesion in the rectum or sigmoid may be. Not long ago Dr. Bowing and I saw a case of carcinoma of the rectum and we did not insist upon a colostomy because the lesion was so small. We could insert the radium so easily through the proctoscope. That patient came into the office just a few days ago with an almost complete stenosis at the site of the lesion. I do not think this is stationary, but it makes me realize that this preliminary colostomy is necessary, just as is the preliminary tracheotomy. No matter how simple the case may appear, we know how easy it is for any patient to develop an edema of the glottis and one often has to do a rapid fire tracheotomy.

So always perform the preliminary tracheotomy and supply the patient with some means of breathing while getting over the radium treatment.

DR. HENRY SCHMITZ, *Chicago*: The point brought out, that only the clearly localized cases of cancer should be operated upon, is one of the most important things that has been told us today. The carcinoma that is no longer a localized disease belongs to radiotherapy. The question arises: When is cancer of the breast localized? If it is localized within the tissue of the breast substance itself, or if it has invaded the skin, or become adherent to the chest wall, or invades the axillary or supraclavicular lymph nodes, it is not any more localized.

We hear frequently about postoperative and pre-operative radiation, and are told that by pre-operative radiation cases are made operable. I think we should discard this view. Raying will destroy the cancer cell as effectively as any surgeon can remove it. If this is a fact I cannot understand why after a radical radiation sufficient to kill the cancer cell, we should resort to surgery afterward. Also, if the surgeon has chosen his case correctly, surgical eradication will remove all of the cancer tissue. Why then should postoperative radiation be used? Hence, the indication for surgical removal is that the cancer is clearly localized within the breast gland. All other cases should be treated with radiations, as surgery cannot hold out any benefits to such cases. If indications were kept sharply defined the permanent cures of surgery would increase in number and radiation therapy would show better results in all the rest of the cases.

It has been stated that in some regions of the body the carcinoma should be removed afterward. This may seem contradictory to you if we refer to my preceding statement. A carcinoma situated in a place where it is free from external or systemic irritation and arrested in its further development by radiation therapy usually remains dormant and often disappears. If the cancer is subjected to local irritation, then after an apparent cure by the rays a surgical excision with fulguration or the cautery should follow.

Observations made in cancers of the mouth, the rectum and on the abdominal wall, where they are continuously subjected to irritation by food, feces, corsets, and so forth, show that they surely recur if not removed after radiation treatment. This may explain the miserable results observed in cancer of the rectum, the bladder and the oral cavity.

The results we see in uterine cancer after x-ray and radium treatment cannot be duplicated in any other part of the body. Ovarian activity is thereby destroyed and the uterus completely necrosed. For all purposes it has been eradicated by the rays. A mass of scar tissue indicates its former location.

DR. HARRY H. BOWING, *Rochester, Minn.*: Although colostomy is undesirable for the patient, as Dr. Skinner said, the patient I saw with him not long ago should have had a colostomy. There are two groups of cases seen, operable and inoperable. In operable cases not only colostomy, but exploration should be performed. Thus, such

cases can be classified without any reflection on either surgery or irradiation therapy. Many cases that are determined operable by digital examination are found to be inoperable upon exploration because of distant metastasis. In those that are decidedly inoperable I do not insist on colostomy. Many patients may live without a colostomy, dying eventually of distant metastasis, not of obstruction. The patient without a colostomy is just as comfortable as the patient with an inoperable growth with a colostomy.

I am sure Dr. Pfahler is right when he insists upon tracheotomy in all cases. It is an early tracheotomy that is of value, and not a late one.

I am sure that all cases that are operable should have the cancer-bearing area removed. If the tissues are predisposed to cancer and the condition is inoperable when first seen, intensive irradiation is indicated and in selected cases, should the patient respond, operative measures should be instituted in order to rid the patient of other recurrences. Even the presence of a fibrous growth or tissue after irradiation, may be a source of irritation; a tumor area that can be removed should be taken care of surgically.

The time interval is interesting to me. When should the surgeon remove the tissue after irradiation? I am sure that two weeks is not ample time. An interval of six to eight weeks is safer, especially in certain patients in whom reparative processes are slow.

DR. MAURICE J. SITTENFIELD, *New York City (Closing)*: I think we are given too much to consider and think of cancer as one definite and specific disease. I am sure, if you will reflect for a moment, you will realize that cancer differs clinically and biologically in practically every organ, and we will probably come to the realization in the future that there is a different etiology and biology for cancer in every individual organ.

It cannot be denied and it is undoubtedly true that heredity plays some etiological part in cancer. Personally I have been interested in this phase in the laboratory and clinic for fourteen years and we cannot get away from the fact that heredity does exert some influence in the immunity and susceptibility to cancer. But do not let us run away with the idea and take it for granted because we see it demonstrated in the laboratory mouse that heredity per se explains the etiology of cancer. There are so many other factors con-

cerned in cancer that heredity alone most likely plays a very minor part; for instance, when a transplantable mouse tumor is inoculated into a heterogeneous group of mice, regardless of any other factor, heredity alone cannot explain the 100 per cent takes. There are so many other factors that necessarily play a part that it is impossible to fasten it to any one.

The biology of cancer is something we know very little about. In the one group it remains clinically local for a number of years, in the other it spreads rapidly and the individual goes to pieces in a comparatively short time. You have all seen tumors that could not be removed in toto because they were in areas inaccessible to the knife and incomplete excision was performed, yet in some cases, these patients have lived for as long as fifteen years and then something occurred and they rapidly went to pieces. We are dealing evidently with more than one factor in the etiology and biology of tumors.

In answer to Dr. Schmitz's question, I would say that the time interval between radiation and operation is something to be guided by individual study. In our observation, we have found that the optimum reaction takes place in twelve to fifteen days. Microscopically, we observe the cell nucleus becomes indistinct and the former cancer cell presents itself as a shadow or ghost of what it was before. This reaction sometimes continues to the fortieth day.

DR. GEORGE E. PFAHLER, *Philadelphia, (Closing)*: I can agree with most things that have been said. I believe in ante-operative treatment, and in my work I try to cover this within two or three weeks. Then I try to have the patient operated, but if for some reason the patient will not, or cannot be operated upon or we decide it is best not to operate at that same stage, I ask to be permitted to put radium needles into the tissue. I think time alone can tell whether preliminary radiation with surgery will give the best results, or preliminary radiation with radium needles. I have had beautiful results from both. Time alone will tell which is really the best method. I believe if you depend upon ante-radiation, that following operation there should also be radiation covering the part that is likely to be involved. We cannot cover the entire body, and we know that the disease may spread anywhere, but we can cover the most likely locations.

The Surgical Aspect of Cancer*

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IN SOME RESPECTS the treatment of diseases today resembles greatly the treatment of the same diseases for many years past. This is particularly true of the treatment of cancer. Surgery is still the domain to which the treatment of cancer is relegated; but efforts are being made to treat this disease scientifically by other means, namely, x-ray and radium.

The surgeon of today feels that he has the responsibility of attacking the ailment first, but he feels at the same time that his methods are not sufficient and he would gladly give up the cancer treatment if some method more effective, more adequate and more lasting in its results could be advanced. Only a hypersanguine and overenthusiastic surgeon could speak with pride of his art regarding cancer. Most of us feel rather on the defensive.

Before we go into the detail of the surgical aspect let us state a few generalities in regard to cancer. The scientific and very extensive experience of Maud Slye, Ph. D., has shown conclusively that among animals there is a considerable hereditary tendency to malignant growth and if we can prove an analogy, it plays an important role in the etiology of cancer in the human; but it certainly must be proven first.

Experience has taught us that cancer always begins at some circumscribed locality, a starting point or primary focus, before it makes its appearance. Certain conditions surrounding this locality remind one that not everything is right or normal there. This condition of not well defined irregularities and abnormalities preceding cancer has led the modern pathologist to speak of a precancerous state of tissues. This precancerous state may exist for some time before the really visible or palpable or otherwise recognizable cancer appears. What these peculiarities in the precancerous state are we are unable to state. In the breast, for instance, even before cancer is detected a condition of hypersensitivity sometimes manifests itself leading the patient to finger the breast, to examine it, and to detect to her surprise that there is a lump; at first it is really a subconscious feeling which leads the patient to suspect that there has been something in the breast for some time.

The cancer begins to spread from the primary focus in the shape of a spray

or fan. The further it spreads from that focal infection the wider becomes the field of the fan or spray until in some instances the whole body of the individual is filled with cancer. This is in general the way the evil spreads until in its progress it produces a condition which ends the life of the individual.

The reaction of cancer upon a body differs. Sometimes the body responds promptly and vigorously and the battle between the individual and the growing cancer is very lively. Sometimes the body wilts away rapidly like a plant in the hot sun, at other times the effect is slow. We call the change produced in the body cancer cachexia, a condition which the experienced eye of the surgeon often recognizes at the first glance and which can be so characteristic as to make the diagnosis of a cancer most probable at first sight. It is the loss of color, the transparency of the skin, the waxy discoloration of the skin, a changed tint, anemia, loss of weight and so on, a complex of symptoms which is very characteristic.

It is only in the very beginning of cancer, in the early stages, that it can be safely removed from the body with sacrifice of local parts in which malignant growth has started. Surgically we say that cancer can be successfully resected; but it also can be burned away, cauterized away chemically, or physically by radium or x-ray. It makes no difference what agency is used so long as the noxious material is thoroughly eradicated. Of course, the art of the surgeon who can dissect the cancer carefully with scalpel and unite the dissected portions so as to restore as much as possible normal contours, must be preferable to the poorly confined activity of an arsenous paste which also destroys the cancer, but which depends for healing upon necrosis and elimination of dead tissue. To the layman such a remedy appears more powerful and that is precisely the reason that at times such crude methods as the burning away or cauterizing away of new growth have celebrated triumphs.

If after the removal of the growth no cancer tissue remains behind which could give rise to a new starting point then the individual is perfectly cured; but in most instances neither the surgeon with his sharp scalpel nor the physician with his burning and cauterizing remedies removes all of the traces of cancerous growth, but some residue is left behind which continues to grow,

thus giving rise to what we call metastases or the metastatic process. This is based on a treatment which has as its

really means nothing but the transplantation of the cancer growth into some part of the body where the transplanted portions can grow immediately and spontaneously.

Another very important factor is that cancer grows best at a certain period of life, the period of decadence and decline. It is during this period that the growth develops most quickly and easily. Upon this fact is based a very important theory, namely: Cancer grows only in tissue in which are some metabolic changes corresponding to those in old age. Some endocrine bodies must be present or absent in order to facilitate the cancerous growth. The most interesting experiments of Fichera in which the introduction of embryonic tissue retarded new growth, were highly suggestive. This observation, which undoubtedly is very important in the study of the development and origin of cancer will probably lead us sooner or later to the real cause of cancer which is at present hidden and unknown. We know only this much, that under given conditions cells become rampant and overrun the place of their first origin and in their vigorous growth destroy natural barriers of such growth. These cancer cells do not seem to be subject to the same law as an ordinary, healthy tissue cell; they show a different reaction from those of healthy individuals. While the natural impetus of growth of the ordinary cell is limited within certain barriers, for instance, epithelium never grows below a certain line called the matrix line, the cell that is cancerous does not know such barriers and breaks through almost every line. While, for instance, the epithelial cells are only on the outside of the body or inside of the cavities of the body and have certain functions and certain histological changes which they never overstep, the cell of the cancer grows into the domain of the connective tissue and into the bone and the nerve or cartilage, respecting no barrier. Cancer cells also show different staining qualities and usually different reactions to the fine physical tests of light, electricity, radium and x-ray.

Upon one of these reactions is based the most important treatment of the present day; it has been found that cells of organized beings are reacting toward the effect of a ray which is not perceptible to the naked eye, the x-ray and the radium ray. It has been found that cancer cells succumb much more easily to the effects of the ray than do

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May 20, 1922.

object the destruction of pathologic cells by the ray.

Inasmuch as the ray can find the cell more easily than can the crude senses, this method is much more useful than the surgeon's knife; it can destroy the cell where it finds it and it finds it when the other senses are blind.

Therefore this treatment enjoys a great deal of favor with the present generation of physicians. It has been found, however, that this ray not only destroys the cell which it finds, but is capable of stimulating the growth at first, and so can at times produce a cancer. Observation has shown that at times cancer grows much more rapidly when exposed to the rays, and in order to prevent such rapid growth the effect of the ray has to be studied very carefully. The amount of radium or of x-ray which can destroy pathological cells and also that which can stimulate them can be ascertained only in a truly scientific way. Reports on this phase have been very carefully sifted down and the value of the rays has to be weighed in every individual case. Herein lies the danger of treatment with x-ray—an unscientific routine treatment may do more harm than good.

Taking it all in all, up to the present day we have not been able to find a more successful method of influencing the growth of cancer cells than surgery or than destruction by action of the rays. Since the removal, however, is only attended with success in the early cases, our slogan must be to operate early and radically.

In the early cases in which total removal or radical removal is impossible, recurrence is very likely; in the rest of the cases, prognosis is doubtful and surgery can only do so much as to make it easier for the rays to destroy the cancer cells.

Rays can produce an effect to a certain depth in the tissues, and a therapy which is used for deep seated cancer must protect the overlying tissues, hence we use filters—but filters absorb a great deal of the power of the rays. It is our opinion that if we wish to affect deep seated tissue more vigorously we should remove the protecting skin and overlying tissues if they can be spared, and for this reason my brother and myself have advocated the removal of large areas of skin overlying deep seated cancers and also have advocated leaving the cancer bed exposed after removal of the growth so as to give the rays free access to the tissues.

As to the relative merits of the different methods used in combating cancer and their indications from the standpoint of the surgeon, we have to report as follows:

The first method is prophylaxis. To know the evil is already one-half of the victory, early knowledge is necessary. Let us, therefore, disseminate among the public the knowledge of cancer and all we really and truly know about it; but let us take good care not to overdo in this direction and thereby produce the opposite effect which we are then likely to obtain, for cancrophobia is a disease no less formidable than cancer. Many can be happy, even with cancer, but cancrophobes are all unhappy.

In the first place only the intelligent can understand, the unintelligent must be lead, and herein lies the great difficulty. Physicians first of all must be instructed, and let us admit that many of them do not know enough about this subject and therefore cannot be leaders. We have to instruct physicians first. Newspapers can do a great service, for they are a medium of disseminating quickly and broadly knowledge of things worth knowing; but they are given a great deal to sensationalism and they bring glowing reports of cancer cures and discoveries which are not based on facts. They are responsible for spreading many false conceptions among the public; they must, therefore, be drawn into the circle of the agencies which work along with the profession in the dissemination of proper knowledge. Genuine popular knowledge of cancer explained in plain language ought to be very useful to the public.

One of the great methods of prophylaxis will be along the line of hereditary influence. Eugenists will be very thankful to Maud Slye, Ph. D., for what she has done, but it takes many, many years to produce eugenic results of appreciable character of this kind and we have to work more quickly if prophylaxis would be of avail.

Secondly, as soon as the cancer is discovered let us use our most vigorous methods to eradicate it immediately, surgically if possible, by an experienced surgeon. Let us enter into a little of the detail on this point. As soon as cancer is discovered let us work quickly. At this point there are many pitfalls; in the first place there are many cases in which cancer is not demonstrable and even the best of pathologists are baffled in the diagnosis. Many cures of so-called cancer are not cancer at all. I could mention many cases of my own in which there is no recurrence of cancer after twenty-five years or longer. Diagnosis clinically and even microscopically seemed to be certain at that time, but it seems doubtful now. If such a difficulty exists as a result of ignorance, how much more must it exist as the result of deceit and fraud. Let us first of all be honest, and if we do not know let us say so and let us

brand every deceit and every fraud as such.

On account of the lucre which is so easily obtained from the person who fears this dreadful malady many fraudulent institutions are working under the disguise of scientific methods and many imaginary or otherwise innocent rearrangements are treated as cancer; such cures are heralded far and wide, but they are not cancer cures at all.

First of all there should be the effort of the genuine physician to establish truthfully a diagnosis if such is possible at all and call only genuine carcinoma cancer. Here would be the place for the activity of a commission of the American College of Surgeons or some purifying institution appointed by the American radiologists. Hand in hand with that goes the question of an experienced surgeon. What do I mean by an experienced surgeon? A man who for some years has been assisting and helping a master surgeon and who through this method of first hand instruction has become competent in diagnosis and treatment, is a surgeon. There is no quick way to competency—there is a way to competency through self instruction, observation of cases in one's own practice, and observation of the results of one's own operations; but such an autodidact has to go through all the mistakes and hardships of self development, and this is a very arduous road; much more quickly does the ambitious young man arrive at the higher state of development if he devotes a few years to learning the art with an experienced man. It is during this time that one acquires what is called surgical tact and intuition if it is at all possible to acquire.

To such men, after they have learned judiciously to use the art of surgery should be relegated the work of treatment by surgery. An operation may be easy and the young beginner may do any operation and do it successfully; but as a rule it will be the experienced surgeon who will have the success in the majority of cases.

There is one more point which we must bring out: It is our hope that in our time it will be possible for concerted research to find out the cause of cancer and build upon that knowledge a reasonable treatment or prevention of the disease and that cancer will not be operated upon, but treated by some specific cure or hygienic measure.

We ought to stimulate scientific research in this branch. It is up to us here in America to make that effort. We are now looked upon by the world as leaders in scientific work. If we do not work out this problem it will be our fault, because we have at our disposal the means and the talents.

Radium and Roentgen Ray Treatment in Metastatic Testicular Tumors*

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METASTATIC testicular tumor is a vague term for the pathologic condition encountered in patients with this disorder. The patients under discussion in this paper came to the Clinic with various chief complaints and large abdominal tumors, with or without enlargements of the superficial lymph nodes. The history records that a testicular tumor was removed and, in a short time, that is, a few months, an abdominal tumor and, in a small number of cases, local recurrence was noted. The primary tumor was removed in many instances after a metastatic lesion had formed in the abdomen. This opinion is based on the history of abdominal pain and other complaints usually present with the metastatic tumor. A history of injury to the testicle is not uncommon, but it is difficult to evaluate, since it is probable that the enlarged structure made injury possible. The primary tumor is characterized by rapid growth and early metastasis to the lumbar and renal lymphatics, the thoracic structures, and the left supraclavicular space. The embryologist can readily explain the predilection of the lumbar and renal areas. The anatomist can demonstrate the communication between the lumbar lymphatics and the receptaculum chyl, the thoracic duct, and the supraclavicular space where the duct empties into the general circulation. Roentgen ray findings of a mediastinal growth with metastasis to the supraclavicular space are seldom noted in patients when first seen at the Clinic.

Since 1917, more than thirty patients with testicular tumors have registered at the Clinic and have subsequently been treated with radium and deep roentgen ray therapy. One had received a course of mixed toxin treatment, and, at the same time, intensive irradiation. The majority came with a diagnosis of the primary tumor of sarcoma of the testicle, while a few had been given a diagnosis of carcinoma. Most of the diagnoses were based on microscopic examination. The patients were either in good health or markedly undermined in weight and strength. For purposes of study the patients may be classified into two groups:

Group 1, patients having large or small metastatic tumors, with good to fair health; and Group 2, patients having large or small metastatic tumors, with general strength markedly undermined. The size or number of the tumors does not seem to bear a relationship to the loss in weight and strength. The duration of the disease seems to be a factor of more importance than the size of the tumor. The undescended testicle is usually regarded as the chief offender in the production of tumors, although in the thirty patients in the series about one-third are recorded as having an undescended testicle. It may be difficult to make a diagnosis at the time the patient is first seen, particularly since it is a moderately rare condition, and the primary tumor may resemble many of the common testicular enlargements. When the patients were seen at the Clinic, it was not difficult to determine the chief reason for their complaints and to diagnose metastatic testicular tumor. Most of the patients gave a history of having had a testicular tumor removed; in the course of a few months, they developed severe pain in the back, referred down the legs, and some weeks later an abdominal mass was discovered. Narcotics are usually required to relieve the pain.

The differential diagnosis in early cases is not easily made. The primary tumor probably offers the chief difficulty in that cases are reported in which the tumors are mistaken for hydrocele, spermatocele, epididymitis, tuberculosis, and so forth. One patient gave a history of abdominal exploration for tumor which was easily palpable. Examination at the Clinic revealed a definite testicular tumor. The primary tumor had been overlooked. The metastatic tumors cause many symptoms which resemble in a measure the common syndromes of the abdomen. In some instances the history referred to exploration of the stomach, since a duodenal or gastric ulcer was suspected, and in one patient gastro-enterostomy was performed without relief. A diagnosis of chronic gallbladder disease as well as cholelithiasis was made in one case, and cholecystectomy performed; the findings were negative. Many of the complaints resemble chronic or intermittent attacks of appendicitis and it is a common observation that the appendix has been removed without relieving the patient. A Wassermann test on the blood should be made in all cases in

order to rule out the diagnosis of syphilis, since either the primary or secondary tumor may be gumma. In one instance the supraclavicular growth was exposed and a specimen removed for diagnosis. Exploration was performed in a few cases on account of tumor in the renal area, which was suspected of being neoplasm of the kidney. There was sufficient evidence to warrant this suspicion, since the laboratory findings were indicative of renal impairment.

Given a patient who has had a primary tumor of the testicle removed, within a few months has complained of symptoms in the upper abdomen, and a few months later has noted an abdominal tumor, a therapeutic test of one intensive radium treatment may make the diagnosis in seven to ten days. If the tumor is testicular in origin, it will diminish in size. Fresh abdominal wounds delay treatment; at the Clinic applications are not given until the wound is entirely healed. Drainage tubes placed at the time of the operation are of very little service. The irradiation of large areas of the body surface in the region of the tumor is of more value than a small amount of irradiation delivered to a given area through a drainage tube.

The treatment, both of patients with fair or good health and of those with poor health, is practically the same. To all patients who will live a month or six weeks, intensive treatment should be given. There is no known means of estimating whether or not the intensive treatment will be endured. The patients are greatly demoralized, as they have been told of the seriousness of their disease and that their chances for recovery are extremely small. The statistics in these cases are not valuable, since the condition is comparatively rare and the group of patients small. The early patients were inadequately treated. The records show that a course of from 2,000 to 4,000 mg. hours of radium was outlined and that one or two areas were exposed to roentgen ray therapy. The patients were instructed to receive further treatments at home, but in only a few instances was this carried out. One patient's disease was not advanced at the time of examination, but within a few months marked activity developed and he was instructed to consult Dr. Coley, of New York, who gave him intensive irradiation treatment and a course of mixed

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May, 1922.

toxin. When last heard from, one year ago, this patient was in good health.

In many of our cases the metastatic tumors have disappeared under treatment. The patients seemingly are in good health and have returned to their various activities. Their chance for a more lasting arrest of the disease should be greater than that of the patients treated in the earlier series.

In the radium and roentgen ray treatments, the region of the growth is mapped out into areas (Fig. 1), measuring between 3 by 4 cm. and 4 by 6 cm., the number of areas depending on the time of treatment. The first areas treated are small, and when the treatments are repeated, it is essential to increase the size of the area in order to cut down the possibility of over-irradiation of the tissues due to scattering. This treatment will, in the majority of cases, produce a mild first degree erythema with desquamation within four to six weeks, and in some patients a brown pigmentation. Fifty or 100 mg. radium is applied to each area at 2.5 cm. distance. The best substance to use to insure a uniform distance is balza wood. The block measures 2.5 by 3 by 4 cm. The radium is contained in Universal tube applicators, walls of 0.5 mm. of silver and extra filtration, 2 mm. of lead, and 2 mm. of rubber. No distinction is made between tubes containing milligrams and those containing millicuries, provided the measurements are the same. If the body surface to be irradiated is large, twenty to thirty areas, the amount of irradiation for each area is from 700

to 1,000 mg. hours. If there are less than eight or ten areas, 1,000 mg. hours are delivered to each unit. The supraclavicular glandular enlargements are packed with radium. The tumor may be divided into two to four areas. The adjacent skin surfaces are protected with lead and rubber. The lead is 0.4 mm. thick and is sufficiently large to furnish ample protection. The rubber sheet measures 1.5 to 2.0 mm. thick and is large enough to extend 1 to 2 cm. beyond the margin of the lead plate. All applicators and protectors are maintained in place with adhesive plaster (Figs. 2 and 3).

The number of radium treatments varies. In some, one treatment causes the metastatic tumors to disappear, while in others two to four treatments are required at intervals of six to eight weeks. Treatments with radium should be supported with intensive roentgen ray therapy. Many good results followed the use of the old technique, the formula of which was: skin target distance 23 cm., milliamperage 5, spark gap 23 to 24 cm., time seven minutes, filtration 4 mm. aluminum and a piece of sole leather. The number of areas varied from four to eight in the region of the abdominal tumor; the size of areas measured from 7.5 to 15 cm. square.

Our present technique takes advantage of the newer ideas of deep therapy. In the treatment of patients with metastatic testicular tumors high voltages are not essential, although they may be desirable. Such patients in a measure demonstrate an element of truth in the

idea of the so-called carcinoma and a sarcoma dose. The current is sent through a broad focus standard Coolidge tube. In the first treatments, practically the entire lymphatic system is exposed in an attempt to decrease the enlargement and destroy the possible metastatic nodules. Two transverse lines, one drawn at the level of the seventh cervical vertebra and the other at the level of the gluteal folds, are connected with perpendiculars drawn along the lateral wall and middle of the body. These rectangular spaces are divided into four equal areas. Lines drawn on the anterior chest wall at the level of the clavicles and the ensiform cartilage are connected with perpendiculars along the lateral thoracic walls. This square is divided into four equal areas.

The abdominal area exposed to radium is not treated with the roentgen ray. The adjacent abdominal and lateral walls are mapped out into areas measuring approximately 10 to 15 cm. The supraclavicular spaces, axillary spaces, and inguinal glandular areas are mapped into areas sufficiently large to insure thorough irradiation. The formula used at present is: spark gap 23 to 24 cm., distance of skin target 30 cm., milliamperage 5, filtration 6 mm. of aluminum and a layer of sole leather, and time fourteen minutes. This formula may be altered with copper filtration 0.5 mm., and aluminum 1.0 mm., time thirty-five minutes, and milliamperage 5. The other factors remain constant. The cross-fire principle is used.

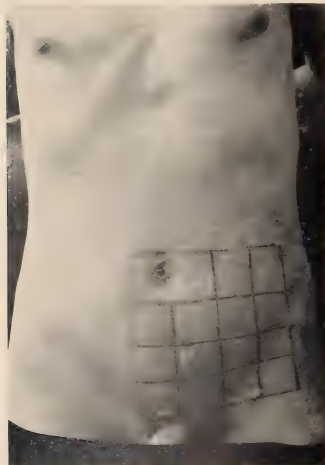


Fig. 1—Methods of mapping out areas in the region of the tumor. The superficial layers of skin are desquamating, with a brownish pigmentation and some areas of mild redness. It is grossly evident that the skin will tolerate this amount of treatment.

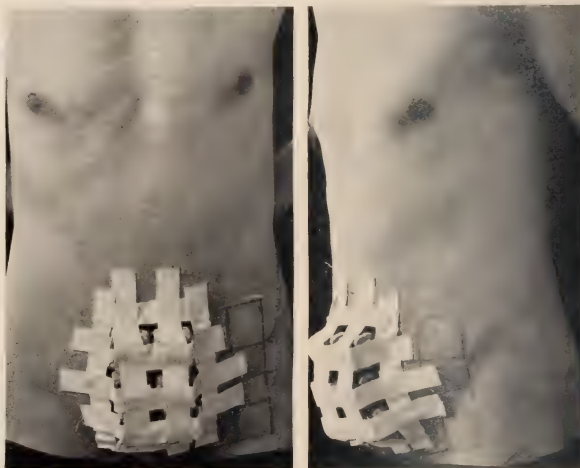


Fig. 2—Balza wood blocks 2.5 mm. thick, 50 mg. of radium filtration, 0.5 mm. silver, 2 mm. lead, and 2 mm. Para rubber fixed to abdominal wall with adhesive plaster.

Fig. 3—Lateral view of Fig. 2.

The patient should be observed at intervals of two months, and if a tumor is not palpable, treatment should not be resumed, although most patients will require from two to four treatments and then a rest of from three to four months.

In the event of negative physical or roentgen ray findings it is safer to treat the symptoms than to wait until a demonstrable growth develops. Lumbar pains are usually indicative of enlargements of the deep lumbar glands.

There is a question of the advisability of reducing the time of application of each block of radium and the amount of filtration. I have not deemed this advisable, especially since these patients are very ill and it does not seem fair to deprive them of a known chance of recovery. The chance of a brilliant primary result is very great, and yet some patients respond in only a fair way. I was skeptical of results in patients with a diagnosis of carcinoma, and yet recently one such patient re-

turned for observation and no palpable tumor could be found. All patients in Group I are given intensive irradiation regardless of the pathologic report. Treatment with Coley's mixed toxins is not advised when the case is first seen. In one patient this treatment was given by Dr. Coley, who reported that intensive irradiation treatments had also been administered. It may be well to consider a course of Coley's mixed toxins should the case prove refractory under radium and roentgen ray therapy.

These patients undergo a general reaction as well as a local reaction typical of all patients treated with radium and roentgen ray therapy; anorexia, nausea, and vomiting are common and usually associated with weakness. If the reaction is not too severe, the treatment is continued. As a rule, four to six blocks are applied at one time, and this is repeated on consecutive days until all the areas have been exposed. If treatment is too severe, however, irradiations are omitted a few days until the patient

returns to a better condition. In order to place the proper interpretation on the reaction, the entire radium treatment should be given and then be followed by the roentgen ray treatment. Patients who suffer from a general reaction are usually given sodium bicarbonate and in some patients marked benefit follows a grain of codein by mouth. The patients are placed on a fasting diet, fluids are forced, and cathartics are given. In other words, the treatment is distinctly that of elimination. The skin is usually treated with a good grade of talcum powder.

Radiologists are accused of being overenthusiastic and overanxious to apply their form of treatment. Legitimate enthusiasm is warranted, but conservatism both in treatment and prognosis is to be cultivated. A most guarded prognosis should be given and no promise of a primary result should be made at the time the patient is first treated.

An X-Ray Demonstration of the Nasolacrimal Passageways--- Normal and Obstructed*

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FEW MORE troublesome problems are brought to the oculist and rhinologist than obstruction of the nasolacrimal passageways, with the attendant symptom of tears discharged over the lid margins. Frequent abscess formation is also a constant menace to the eye itself. Many operations, varying from removal of the sac to reopening the obstruction or making a new opening, have been devised for the relief of this condition, but the pendulum seems to be swinging from the removal of the sac to that of forcible dilatation or making a new opening. In order to determine, pre-operatively, if possible, what is the operation of choice in any given case, we have in the past year and a half been using the x-ray to obtain a picture of the lumen of the passageway and hope to point out in this paper some of the practical points to be derived from this procedure.

The nasolacrimal passageway consists of: (1) The canaliculi, which begin in minute orifices termed the *puncta lacrimalia* near the medial border of the eyelids. They are directed medially, and converging they enter close together, or through a common

opening, into the lacrimal sac slightly below its middle point. (2) The lacrimal sac is the upper expanded portion of the passageway measuring about 12 mm. in length. This has a rounded upper border narrowing below into the nasolacrimal duct and lies in a groove formed by the lacrimal bone and frontal process of the maxilla. (3) The nasolacrimal duct measures about 18 mm. in length. It is directed downward and slightly backward and opens into the inferior meatus of the nose, terminating in a somewhat narrowed orifice.

Many and varied forms of treatment have been advocated for the relief of this condition, but most of these can be classified under three heads: (1) The passage of metal probes or curets through the constriction, attempting thus to relieve the obstruction. This is very painful and has to be repeated many times and therefore can never be a popular method. (2) Removal of the sac by operation or its obliteration by the use of a caustic, resorted to in despair of any method of keeping the passage open and also because of the danger of abscesses in this region. The objection to this method is that it makes no provision for the drainage of excess tears which must then drain over the lid margin, a constant source of discomfort to the patient. (3) Making a new opening into the nose to es-

tablish free drainage for the tears and to prevent pus formation in the sac, hoping by this means to restore normal function. This operation is accomplished by making a short circuit from the sac into the middle fossa of the nose by means of a large window in the lateral wall. West, in 1910, was one of the first to popularize this form of intranasal operation.

It is quite evident that in this form of operation precision is considerably reduced by the lack of pre-operative knowledge concerning the exact point of stricture and the size and shape of the sac above this. An attempt has been made in this work to produce a radiograph of the portion of the sac above the stricture, in relation to the surrounding structures, and also to show the size of the opening in the lateral wall of the nose following the intranasal type of operation.

The technique followed in this work has been, first, to undertake the usual routine of attempting to syringe solutions, by way of the *puncta*, through the sac and duct into the nose. Following this the passageway is injected with Beck's bismuth and oil paste. This is accomplished by first dropping a few drops of two per cent cocaine solution on the lower lid. The sac is then cleared of mucus or pus by pressure over this. The passage is then syringed

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May 20, 1922.

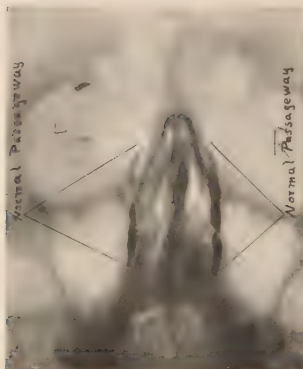


Fig. 1—Normal case showing both passageways as seen in the posteroanterior position.



Fig. 2—A normal passageway as shown in the lateral



Fig. 3—Normal case, showing a side to side junction of the sac and duct.

out with normal saline to which a few drops of 1 to 1,000 adrenalin solution have been added. It may be desirable to dilate the puncta slightly, but under no circumstances do we slit the canalculus. It is also necessary in some cases to obstruct the puncta not used in the injection and this may be done with a common pin. The passages are then injected with the bismuth paste, using for this an ordinary all glass Luer syringe and a No. 19 blunt needle. When necessary to warm the bismuth, dry heat should be used, as steam will precipitate the oil out and difficulty will be experienced in getting an even flow through the fine caliber needle. About 1 c.c. will be used on those cases without obstruction, while one-half that amount will usually suffice in those with obstruction.

For purposes of localization with respect to the surrounding structures it

is very valuable to place a small silver rider over the anterior end of the middle turbinate just below its attachment to

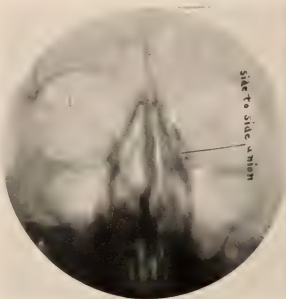


Fig. 4—Normal case, showing side to side junction of the sac and duct.

the lateral nasal wall. Another method of considerable value is that of outlin-

ing the position of the anterior end of the middle turbinate by a strip of bismuth paste. This is easily accomplished using a long lacrimal needle for this purpose. A radiograph made in the lateral position will then show how much of the unobstructed passage lies above or below the root of the turbinate and also whether it is in front or back of the turbinate.

In our experience there is no harmful effect associated with this procedure, either in the normal or obstructed passageway, if it is carried out by some one familiar with the technique of syringing the passageways and if ordinary care is exercised. If properly done the patient usually complains of no discomfort from this injection.

Following the injection radiographs in several positions are made of this region. The positions which we have found to be the most valuable are the

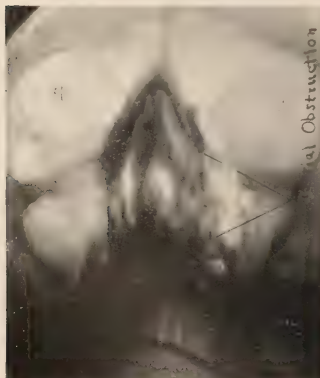


Fig. 5—Same case as Fig. 7. Shows partial obstruction on left. The duct is very narrow and constricted.



Fig. 6—This case shows an obstruction high up in the duct. A metal rider indicates the position of the middle turbinate on this side. Before operation.



Fig. 7—Obstruction at junction of sac and duct.

following: (1) The Waters-Waldron sinus position, in which the chin rests on the plate with the nose slightly elevated. (2) This is a modification of the Waters-Waldron position. The head is rotated toward the side which has been injected with the bismuth paste. This tends to throw the injected sac over the shadow of the ethmoid cells and will cause the sac to stand out with considerable clarity. (3) Here we use the forehead-nose position, which also tends to throw the sac over the ethmoid shadows. (4) This position is with the head in a true lateral position and it is very important to gauge the anteroposterior position between the sac and the middle turbinate, which is marked by the metal rider or stripe of bismuth. We have found stereoscopic plates to be of great value in determining the position of the various structures.

During the last twenty months we have studied about 80 cases, including both normal and obstructed cases. In the normal cases a number of variations from the generally accepted normal have been found. In a number of these cases, the passageway has been very much twisted and tortuous in shape, with considerable variation in its lumen; also while normally the sac and duct are joined in an end to end union, several cases have been found presenting a side to side union, and it is easy to see how, in many of these cases, one would be doomed to failure in attempting to pass a probe through this.

In this series are included a number of negroes, and in individuals of this race the nasolacrimal passageway was found to be unusually wide and straight which probably explains the relative rarity of pathology in this region among members of the black race.

In those cases presenting a definite obstruction two extremes have been found: (1) Where a portion of the sac is very much dilated, similar to the dilation seen in the esophagus above an obstruction. (2) Many showed the sac to be very small because of abscess formation followed by scar tissue contraction. All grades between these have been seen. A number of cases giving symptoms of partial obstruction have been examined and in these cases we have found areas of constriction, but not obstruction, which apparently are ample for the ordinary needs, but which fail to function properly when there is a considerable quantity of tears to be carried away. Very valuable pre-operative information is obtained by the surgeon as to the type of sac present. This will have considerable influence as to the type of operation decided upon.

POSTOPERATIVE DATA

The x-ray plate has been of value in several postoperative conditions: (1) In those cases in which a short-circuiting operation into the middle fossa of the nose has been performed, the exact size of the opening can be noted and a fairly accurate prognosis made as to the permanent relief of the patient's symptoms. (2) A number of cases having had operations for removal of the sac, later complain that they are able to express pus from the lacrimal fossa. By means of the x-ray we are definitely able to show if the sac has been removed in toto or in part, and if the latter is the case, how much of the sac remains and what is its condition. This information is of great value to the surgeon in determining if enough of the sac is left in place to make a short-circuiting operation into the nose feasible, or if it would be better judgment to completely remove the remaining portion of the sac.

RELATION TO SINUS PATHOLOGY

Owing to the belief in many circles that disease in the nasolacrimal passageways is usually associated with or caused by chronic pathology in the paranasal sinuses, it has been deemed wise in this series to compare the relative occurrences of the two. We have been struck by the relatively high proportion of cases showing pathology in the sinuses associated with pathology in the lacrimal apparatus.

In a series previously reported by us there have been twenty cases of complete obstruction of the passageways. Among these, sixty per cent showed evidence of chronic pathology in the paranasal sinuses and every one of these showed involvement of one or both maxillary sinuses, which are the sinuses most intimately associated with the lacrimal sac and duct. While this series is very small to draw any conclusions from, we hope that others will report their statistics, when available, to prove or disprove this point, and we have in progress at the present time a more detailed study of this point, which we will report at a later date.

TABLE I.

<i>Sinus Involvement in Obstructed Cases.</i>	
Pathology in sac or duct.	20 100%
Pathology in sinuses.	12 60%
No pathology in sinuses.	8 40%

TABLE II.

<i>Relative Involvement of the Sinuses</i>	
Pathology in antra.	12 100%
Pathology in ethmoids.	3 25%
Pathology in frontals.	0

TABLE III.

<i>Comparative Pathology on Obstructed and Non-Obstructed Sides.</i>	
Sinus pathology found.	12 100%
Sinus pathology same side as lacrimal pathology.	9 75%
Sinus pathology opposite	

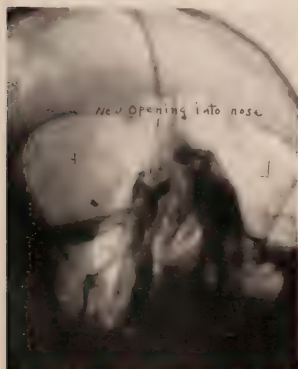


Fig. 8—Same case as Fig. 7. Shows operative opening into nose with bismuth passing through this.

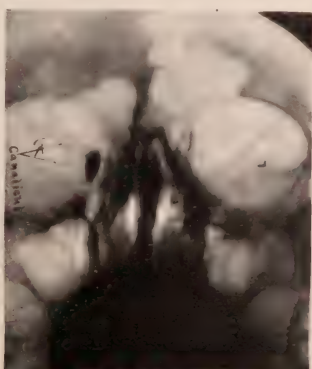


Fig. 9—Before operation. Shows an obstruction at the junction of the sac and duct with some dilation of the sac.

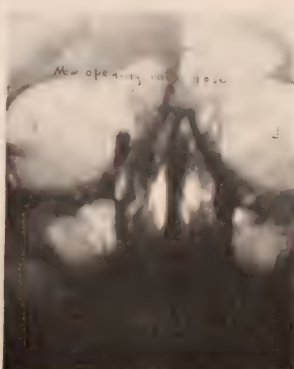


Fig. 10—Same as Fig. 9. Shows operative opening into nose with bismuth paste passing through this into the nose.

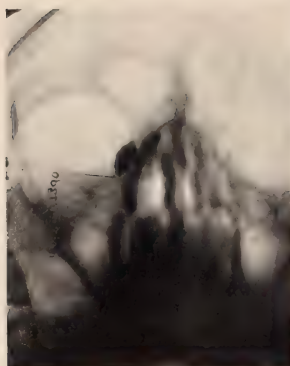
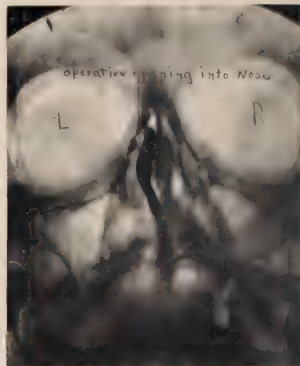


Fig. 11—Before operation. Shows obstruction at junction of sac and duct.



Fig. 12—Same case as Fig. 11. Shows operative opening into nose. The opening in this case was too small



and had to be enlarged later. Fig. 13—Shows an obstructed sac with an operative opening into the nose and a large amount of bismuth paste which has passed into the nose.

side of lacrimal pathway 3 25%

CONCLUSIONS

It would seem apparent that the x-ray offers much valuable information which was heretofore unobtainable by the older methods of examination. Some of the cases in which it has been found to be of value are the following: (1) In cases of complete obstruction one may determine exactly the point of obstruction and the condition of the sac above

this. (2) Postoperatively one may determine the size and position of the operative opening into the nose and also the rapidity with which the opening closes in cases progressing poorly. (3) The subsequent progress of cases of partial obstruction may be followed to determine the form of therapy to be used. (4) Following operation for removal of the sac it can be definitely determined whether the sac has been completely removed. (5) Cases presenting symptoms of partial obstruction, but showing normal passageway by

means of x-ray examination, should be investigated for evidence of reflex stimulation of the lacrimal glands as the cause of epiphora. (6) The condition of the paranasal sinuses, especially the antra and ethmoids, as a possible cause of the obstruction, can be noted. (7) The relative position of the middle turbinate can be determined as an aid in cases where operation is to be performed. (8) Anatomical anomalies which would make probing operations dangerous can be pre-operatively determined.

Peptic Ulcer*

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PEPTIC ULCER is a disease so increasingly common and so disabling, the recent advances toward its accurate identification so significant, the economic element involved in its treatment so important that frequent discussions seem justified as well as much study demanded of those whose responsibility it is to deal with these unfortunate patients.

In attempting to prepare a paper on this subject the writer is not unmindful of the vast scope which the subject contemplates when followed into its various ramifications; for even a reasonably exhaustive discussion of gastric or duodenal ulcer alone would require many pages. Neither are we unmindful of the many excellent articles written on this subject in the past decade by men

of prominence and broad experience.

The object of this paper is to contend for the actual demonstration of the deformity in peptic ulcer. This contention will be discussed under two general heads: (1) Personal disappointments with the indirect signs, and (2) Insistence upon finding the deformity of the gastric and duodenal contour.

A prominent Texas surgeon was heard to say in a recent discussion that no clinic is doing extensive gastric surgery without the assistance of a competent roentgen ray department, because there is no other way to definitely localize and identify the lesions or to convince patients of their need of surgical attention.

Mills, (1) a clinician of St. Louis, sets a high standard for us and therefore places a great responsibility upon the conscientious worker who would verify his remark when he says: "There is no precedent, in any specialty, for such a revolutionary factor

suddenly developing, as the x-ray has proven to be in gastro-enterology. Successful abdominal diagnosis, prior to its advent, was devious and largely a matter of shrewd guess work. It has been transformed by roentgenology, as practiced by skilled men, into one of the most accurate subjects in clinical medicine. The influence of the x-ray on subjects collateral to gastro-enterology, surgery, topographical anatomy and alimentary physiology is very great—only relatively less important. It has no limitations. The limitations are our own. Its only weakness is in its strength. * * * It is conventional to assume a pose of conservatism on the value of the x-ray in gastrointestinal work, but I have little doubt that the foregoing is about what, with good reason, we really believe, and it certainly seems the position of thinking clinicians today."

As intimated above, it is obviously impractical to undertake to deal with minutia of the various deformities and

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May 19, 1922.

manifestations roentgenologically encountered in gastric examinations; but, in the hope that we may emphasize some phases of this important work and elicit a discussion which shall be helpful to all, we herewith present a brief review of the present status of gastro-intestinal roentgenology as it relates to peptic ulcer in our institution, a surgical and general diagnostic clinic.

Upon admission the patient is taken in charge by the clinical department, where a careful history is written and such preliminary examinations made as seem indicated. He is then referred to other departments according to indications. Those patients suffering from any of the following symptoms are referred to the x-ray department for the examination of the gastro-intestinal tract: Vomiting, epigastric pain, hemorrhage from the stomach or bowels, progressive loss of weight, marked anemia, upper abdominal colic, epigastric tumor, visceroposis, vague abdominal distress without symptoms which are referable to certain organs, indigestion or the so-called chronic dyspepsia (which term covers a multitude of sins), and sometimes examination is made to satisfy the patient, the attending physician, or the clinical staff. Richard Behan⁽²⁾ in his monograph on *Pain* makes this significant statement, "Almost 90 per cent of all diseases either begin with or have pain as their prominent symptom at some time during their course." Other clinicians say pain and hemorrhage send most patients in search of medical advice. Since a large percentage of patients suffer with some of these various symptoms and since the clinical evidence alone is sufficient in only about 50 per cent of the instances, according to eminent clinicians, any method which offers reliable assistance is eagerly sought and welcomed by all concerned.

For purposes of this study, we have consulted the records of 2,844 patients examined since January 1, 1918 (13 per cent of the clinic admissions) which came under one or more of the foregoing classifications. We shall refer, however, only to those cases which were roentgenologically considered as peptic ulcer. There were 363 of these, or 12.7 per cent of the number examined.

As roentgenologists, we are perhaps all agreed that the details of technique are not of so much importance as that we should develop a technique best suited to our conditions or inclinations and consistently follow it, for it is the frequent repetition and careful comparison of the observations of physiological phenomena, which prepare us for accurate interpretations. It is said that Dr. Osler once asked a medical

student how he recognized a certain patient as having "paralysis agitans." The young man began to answer by enumerating the symptoms of the disease in question, when the wise teacher interrupted and said, "No, saw it before."

The patient for gastro-intestinal study reports at 8 a. m. with a fasting stomach, breakfast and all drinks omitted, although his daily routine with reference to meals and medicine is not interrupted even for one day previously. We do not agree with the statement of some that gastric lavage is necessary to guarantee an empty stomach, for we have had patients come from the lavage room when the clinician thought he had emptied the organ and we have found considerable liquid contents in it. But emptiness, while very desirable if practical, is not the most important element, for the administration of a test meal or even the passage of a lavage tube produces irritation and other abnormal conditions which are unnecessary and which in many cases may require tedious and unsatisfactory explanation when doubtful findings are encountered. The important thing is that the conditions be as nearly normal as possible for that patient. Then if residual contents are present it is a significant fact and should be explained by subsequent findings.

The examination is primarily a fluoroscopic one and in the upright position when possible. Roentgenograms are made only for record, for confirmation or for purposes of demonstration. The writer has not yet succeeded in radiologically demonstrating a lesion that has not previously been seen on the fluoroscopic screen. On the other hand, it is oftentimes very difficult to make films of the stomach adequately disclose the identity of a lesion undeniably seen under the fluoroscope. We do not read the history and very seldom question the patient except as to breakfast. If this meal has been omitted we proceed, except under extraordinary circumstances, otherwise the patient is sent away to return next morning without breakfast. The bariumized milk meal, preferably buttermilk, is used almost exclusively, sometimes plain water or a malted mixture is used. Interval observations are made to determine the function of stomach and intestines.

For the sake of brevity we will attempt only a discussion of the positive gastric and bulbar findings, since including the negative findings would lead us far afield and would necessarily be tedious to you who are so familiar with them.

During deglutition the muscle tonus of the stomach is observed and may be classified as good, fair or poor, accord-

ing to the manner in which the food is held toward the fundus in funnel shape and allowed to settle to the most dependent portion of the organ as the contents separate the walls. This ranges from sagging of the organ to cases in which the organ fills as a cloth bag would fill, allowing the contents to settle immediately to the lowest portion.

Having distended the stomach with the opaque meal (10 to 14 fluid ounces), our observations are directed to the behavior of the peristaltic waves. Usually where pathology exists we have one of the two extremes, hypoperistalsis or a hyperperistalsis, depending upon the character and location of the lesion, the duration of its existence and whether obstruction is present. In cases of obstruction at or near the pylorus we may have alternating periods of these two extremes. Hypoperistalsis is often seen in atonia, and hyperistalsis is seen in acute abdominal inflammatory conditions such as cholecystitis, appendicitis, etc. We have also observed this latter phenomenon in cases of morphin addiction, pellagra, and in patients who had undergone cystoscopic examination within the past 24 hours.

Luminal contour next deserves our attention and upon this we cannot place too much emphasis.

Two years ago, before the Texas Roentgen Ray Society I discussed the radiological signs of gastric carcinoma, and held the one pathognomonic sign to be the deformity—the filling deficiency which must interrupt peristaltic waves and have lessened flexibility, and which is usually tender and sometimes painful.

One year ago, before the same society, the same test was applied to peptic ulcer, both gastric and duodenal, that is, deformity is the one unfailing evidence upon which to base a diagnosis of ulcer, granting that we are not expected to differentiate as to malignancy in doubtful cases. To grant this is obviously fair, as the roentgenologist should not be required to do that which the surgeon and pathologist are often unable to do with the gross specimen in their fingers, but frequently they have to make microscopic sections for final decision as to malignancy.

In a paper⁽³⁾ before this society at the last annual meeting, December, 1921, Carman in discussing errors in the roentgenological diagnosis of duodenal ulcer, makes this statement: "Laying aside the various minor and indirect signs of duodenal ulcer there are but two trustworthy indications of this lesion. They are deformity of the duodenal contour and the combination of retention and hyperperistalsis in a large but otherwise normal stomach."

With this I have no contention ex-

cept that I am willing to subtract the latter of these two and place the entire responsibility on the former, that is, the deformity of the duodenal contour, and let the principle equally apply to the gastric contour in gastric ulcer as well.

Frequently in these conditions there is such marked obstruction either mechanical or spasmodic that relaxation of the pylorus is much delayed and difficult to accomplish, but usually with the exercise of sufficient patience and with vigorous manipulation, and sometimes right oblique recumbent posture, sufficient relaxation can be affected to allow visualization which will lead to a clue. The writer recalls two cases in which relaxation was never seen in both of which cases a diagnosis of carcinoma was made. One proved to be a case of gall stones, the other a dense mass of adhesions around the duodenum. These and other errors have led to our present contention of insisting upon the deformity.

These deformities, whether on the gastric or duodenal side of the pylorus are of many types, the niche, the pocket, the cauliflower-like perforation, the induration, the slight excavation and others. The meniscus recently described by Carman has not come under my observation. These deformities may occur in any portion of the stomach, but the large majority are found on the lesser curvature and in the pyloric end. In the duodenum perhaps 95 per cent or more are in the first or bulbular portion. In our series only one other was found, and it was in the second portion of the duodenum and produced a marked obstruction. There are spastic manifestations, incisura, hypoperistalsis and hyperperistalsis, retentions and other signs of contributory nature, when properly interpreted, but if unaccompanied by deformity it will be questioned as to whether they are dependable. If so, to what extent and in what types? There are those who claim that 25 per cent of duodenal ulcer diagnoses and a certain number of gastric ulcer diagnoses are made on indirect signs. And, of course, there are a fair number of superficial lesions, mucous erosions and slits which manifestly do not give rise to luminal contour deformity, and are not detectable by any means except direct inspection. There is another class in which the ulceration has involved the deeper structures, but on account of their location they are difficult and sometimes impossible to identify roentgenologically.

In the gastric cases deformities are due to perigastric adhesions, pressure from abdominal tumors, especially the pancreas, liver, gall-bladder and other neighboring organs, spasticities of in-

trinsic and extrinsic origin, cicatricial contractions, perforations, etc. In the duodenum these occur at the base, the apex, the anterior or posterior wall, greater or lesser curvature, and are due to causes the same as enumerated for gastric ulcer.

Our most serious difficulties are encountered in those patients who are suffering with chronic gall-bladder disease, especially those broad, thick individuals in whom this seems most likely to occur, where as a rule the stomach assumes a high oblique position and the duodenum turns abruptly backward or to the right behind the antrum, and many times, too, the bulb is involved in a mass of adhesions, all of which makes it not only difficult to effect relaxation of the pyloric sphincter, but very difficult to visualize as well, since under these circumstances the bulb empties so rapidly. In such a case we turn the patient to the right or left anterior oblique, and, failing in both these, to the left postero-anterior oblique position, constantly manipulating with the hand. Failing in all these maneuvers we have the patient lie on the trochroscope on the right side, in which position we again manipulate, turning him about as seems indicated. The rewards for the expenditure of this time and effort have been sufficient to amply justify it and make us less dependent upon indirect signs. There are cases, to be sure, which in spite of all such measures are indeterminate. But as compared to the strictly radiographic method the fluoroscopic method is much less expensive both as to time and materials, and the results in our opinion are equally reliable.

As to the drainage time, in our experience it is a sign of only minor importance for diagnosis of organic lesions. We have seen many cases of frank pathology, both in stomach and duodenum, confirmed at operation where the drainage time had been well within six hours. On the other hand, we have seen many cases with drainage time well beyond six hours, up to twenty-four hours, go to the operating table for various abdominal conditions, but in whom no gastric or duodenal pathology could be found (24 hour retentions).

We were interested some time ago in examining 100 people in whom there were no symptoms referable to the gastro-intestinal tract. These were people in good health and in active business. There were included doctors, nurses, stenographers, bookkeepers, record clerks, janitors, cooks, waitresses, yard-men, and other employees of the institution. We observed very stringently the condition that there be no gastro-intestinal symptoms and used the identical technique that we used

with patients. These observations convinced us that gastric drainage frequently goes beyond the six hour limit in well people, and that it is dependent upon the general muscle tonus, the habitus, etc., as well as upon spasticity or organic pathology. We were also impressed with the fact that the position of the organ is a matter of habitus, tonus and intra-abdominal pressure. In several of these people of tall, slender stature, the lower border of the stomach reached to the level of the pubis and yet the organ drained itself within the average time, which in these 100 proved to be four and one-half hours. Thus, it would seem that we scarcely know where we stand in the diagnosis of a given case unless we can demonstrate a pathological lesion by positive deformity.

We have also recently been interested in a variation from the usual technique in that we have given the patient a glass of bariumized milk along with the normal breakfast, that is, the breakfast which they have been accustomed to eating, whatever it might be. To date we have handled 257 patients on this basis. They are asked to abstain from further food or drink except a sip of water until the sixth hour observation, at which time the stomach is fluoroscoped for drainage and the usual bariumized milk meal repeated for determination of organic pathology. There has been no apparent difference in the drainage of this meal of mixed diet and the strictly milk or liquid meal.

It so happens that we have classified 63 cases of peptic ulcer in these 257 patients as follows: Gastric ulcers 14, duodenal ulcers 49, of which number 13 have been operated upon and, fortunately, all confirmed. No special credit is intimated, for there is perhaps no special advantage from a diagnostic standpoint in this method, but it is certainly pleasing and much more comfortable to the patient and is perhaps in every sense reliable.

We have found some interest in the fact that, in our clinic, ulcer of the duodenum occurs more frequently in males than in females. In this duodenal ulcer series of 237 cases there are 172 males to 65 females. In the gastric ulcer series of 126 cases there are 88 males to 38 females. A comparison of the relative occurrence of gastric and duodenal ulcer in the two sexes is given in the following table:

	Gastric	Duodenal
Both Sexes	126	237
Females	38	65
Males	88	172

Several cases have been encountered in which a double lesion was suspected and such opinion expressed, in one of

these both the gastric and duodenal ulcer were demonstrated at operation. In three others we recall the lesion was single and in an analysis of separate lesions would count against percentage of confirmation but classed as peptic ulcer would favor percentage of confirmation. Scar tissue contractions, adhesions and reflex spasms are responsible for these failures. Gall-bladder adhesions involving the duodenum are another source of error, as is also a dilated duodenum. Carcinoma of the pancreas has been mistaken by us for gastric pathology in at least two instances.

Among the 2,481 patients regarding whom we offered a negative opinion, five records exist in which peptic ulcer was found at laparotomy. One of these was gastric and four were duodenal. One of these had been examined twice and symptoms were so characteristic that exploration was advised by the surgical staff but declined by the patient. The patient returned to the hospital in less than thirty days, moribund, and at autopsy perforated duodenal ulcer was found. One duodenal case was examined twice, the first time the findings were questionable, the last time negative. Perforation, hemorrhage, obstruction, malignant degeneration and

the disabling effect of long continued limitation of diet, are serious and unfortunate complications. As to malignant changes we have no direct evidence to present, but there is much argument to support the claim. For these and other reasons a large proportion of peptic ulcer cases are considered surgical and we are happily so situated that our surgeons always notify us when a case is to have laparotomy. This privilege has been of as much assistance to us in finding the causes of our errors and confirming our opinions as perhaps any single factor. A comparison of the roentgenological evidence, with the findings at operation, serve as the basis for the following table:

PEPTIC ULCER

	Gastric	Duod.	Total
Cases	126	237	363
Operations	31	80	111
Confirmations	29	76	105
Percentage Confirmations	94.5		

The operative records also reveal two cases which were not submitted to x-ray study, one was an acute perforated gastric ulcer, the other a duodenal ulcer associated with a cholecystitis.

CONCLUSIONS

1. We do not believe that 100 per cent peptic ulcer diagnoses can be made either positively or negatively by any method.

2. We do not claim to differentiate pathologically in doubtful cases.

3. We cannot forecast the mortality rate.

4. We believe that persistent, careful and conservative gastro-intestinal radiology is worth more than 90 per cent in eliminating or confirming organic diseases.

5. Indirect signs stimulate more careful search and are of contributory value only. The deformity of stomach and duodenum is the one evidence upon which the diagnosis is based.

6. A sane and sensible correlation of the roentgen ray with other methods is the path which leads to conservation of the highest interests of our patients and to the greatest credit of the medical profession.

FOOTNOTES

(1) Am. J. Roentgenol. 7:523, Nov., 1920.

(2) Richard Behan, *Pain*. Appleton & Co.

(3) J. Radiol. 3:163, May, 1922.



Bone Diseases---Osteoporosis or Lipomasia from Fixation and Non-Use*

(Second Report on the X-Rays of the Final Result)

JOSEPH COLT BLOODGOOD, M. D.
Baltimore, Maryland

SINCE the first article was published (*J. Radiol.*, 3:403, Oct., 1922), I have received the x-rays of the present condition of the involved bones in Cases 1 and 2, and as they still show definite changes in architecture and as the patients are clinically well with complete restoration of function in the knee-joint, it seems important to make the first article complete, to record the fact and to reproduce the x-rays.

Case 1—(Pathol. No. 15865)—The first x-rays of this patient of Dr. Ramsey of El Paso, Texas, were taken in 1914; these have been lost, but were strikingly similar to those in Case 2 (Figs. 1 and 2). This patient has just sent me the x-rays of the present condition, eight years later.

Figs. 1 and 2 show the contrast between the lower end of the femur, the upper end of the tibia and fibula of the knee previously affected and the uninvolved side. The irregular markings of darker shadows suggest excessive new bone formation, that is, the

old area of osteoporosis has now become osteosclerosis, but the architecture of the involved area has not been restored to normal. The contrast between the normal and the abnormal in the lateral views is shown in Figs. 3 and 4. Although I requested x-rays of the ankle in this case they were not sent.

Case 2—(Pathol. No. 23881)—Patient of Dr. K. H. Beall of Fort Worth, Texas. This patient was observed in 1918, four years ago, and the lateral and anteroposterior views of the affected knee are reproduced in Figs. 1 and 2 of the October article.

Figs. 5 and 6 contrast the normal and the abnormal in the lateral views of the knee-joint. The old areas of osteoporosis show undoubted lines of osteosclerosis. The architecture of the affected bone has not been restored to normal.

In the anteroposterior views of the two knees (Figs. 7 and 8) the changes in the architecture and the sclerosis are not so marked as in the lateral view.

The most remarkable feature is the architecture of the lower end of the tibia and fibula and the tarsal bones.

These show the same changes, in contrast to the normal, as the x-rays of the knee-joint. These x-rays of the ankle-joint (Figs. 9, 10, 11 and 12) which show the end result four years after the injury and non-use, should be compared with Fig. 5 (Case 3) in the October paper, which shows osteoporosis in its recent state.

Here we have evidence, therefore, that this diffuse osteoporosis from non-use, when it heals, is not restored to normal.

Should a patient come under observation because of recent pain or injury, and an x-ray be taken, pictures of this kind might be revealed if there had been a previous injury and a long period of non-use. One, therefore, should always question closely and record the evidence of previous injuries, fixation dressings and non-use. Cases of this kind would have an important bearing in industrial and accident insurance and workman's compensation.

I have in preparation now a paper to be published in this journal on the ultimate healing of the different diseases of bone, whether operated on or



Figs. 1 and 2 (Case 1, Pathol. No. 15865)—X-rays anteroposterior view eight years after onset. Clinically well.

Figs. 3 and 4 (Case 1, Pathol. No. 15865)—X-rays of lateral view eight years after onset. Clinically well.

not, and of latent, unhealed lesions, and their correct interpretation, and there will be soon published in Minnesota Medicine a paper on the *Unhealed or Latent Benign Bone Cyst*.

I take the opportunity here to request readers of the journal to be on the lookout for osteoporosis following fixation and non-use after injury to bone or joint.

We should ask ourselves the question: "Does this always occur, as in the three cases reported in the first paper?" We now know that in at least two cases the osteoporosis present in the joint-ends of bone about the injured knee had occurred as well as in the bones of the ankle on the affected side. We now know that, although joint function is restored and the patients are clinically well, yet the x-ray of the result shows that the architecture of the bone is not restored to normal and it suggests osteosclerosis.

Why is it present only in the joint ends and not in the shaft? If any of the readers have x-rays of cases of this kind, I would be glad of an opportunity to study them.

DIFFERENTIAL DIAGNOSIS FROM TUBERCULOSIS

I mentioned this in the first paper. Since then it has been given further thought and study. I cannot find an example of tuberculosis with such extensive softening (osteoporosis) in the joint ends of bone as pictured in these cases without some destruction and perforation of the cortical bone. In the

three cases observed by me and reported here, there is no destruction of the cortical bone to be made out, although it is thin. I cannot find a case of extensive tuberculosis of the bones of a joint without evident joint involvement in the x-ray and on palpation, absent in the three cases reported here.

Again, in tuberculosis, the epiphysis may be extensively involved without involvement of the shaft. Here the shaft is involved as well as the epiphysis, although the osteoporosis does not extend far into the shaft.

DIFFERENTIAL DIAGNOSIS FROM METASTASIS AND MULTIPLE MYELOMA

I mentioned this in the first paper and restudy confirmed the statement there made.

Two recent cases of cancer of the oral cavity in which the tumor infiltrated to the bone demonstrate that we are not familiar with the changes which take place in the x-ray picture of the lower jaw after extraction of teeth and in patients who have not plates. In one case, that of a man aged 74, whose teeth had been extracted many years ago, and who had worn a plate, the shadow of the marrow cavity of the lower jaw about the shadow of the inferior dental canal was different from normal. It either was osteoporosis or carcinoma. It was interpreted by one roentgenologist as carcinoma, but exploration of the bone revealed no carcinoma.

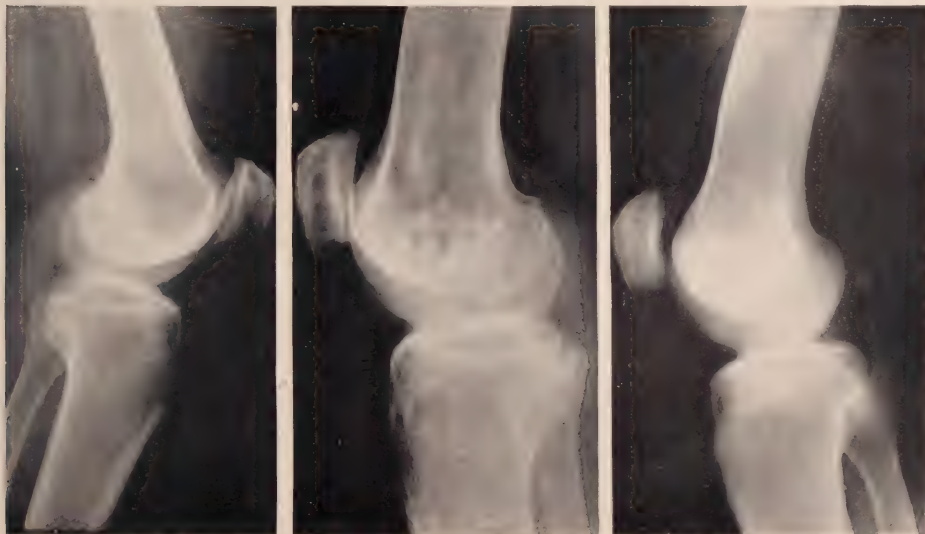
In the second case, there had been an extensive cancer of the lower lip; it was excised. In about six months a nodule formed on the jaw in the region of the mental foramen on the left side. The x-ray shows that the mental foramen is larger and irregular and about this shadow is another larger irregular softened area in the lower jaw. This was interpreted as carcinoma, and at operation we demonstrated the direct growth of cancer from the nodule on the jaw through the foramen into the marrow cavity of the jaw.

I have a paper now partially completed which will comprise a study of the central tumors of the lower jaw and their x-ray pictures.

I would be very thankful to any roentgenologist who reads this article if he would send me x-ray pictures of the lower jaw showing changes from normal in which there has been no clinical evidence of disease. The number of x-rays of the lower jaw in my collection from which all the teeth have been extracted is very small.

CONCLUSIONS

These few carefully studied cases demonstrate that there is a field for investigation in x-ray studies of the changes in bone after contusion and after prolonged fixation and non-use, and these x-rays should not only picture the bone shortly after the injury, but at intervals throughout a long period of observation.



Figs. 5 and 6 (Case 2, Pathol. No. 23881)—Lateral

views of affected and non-affected knee four years after onset. Clinically well.

Footnote—November 6, 1922.

Dr. Emil G. Beck of Chicago has written me Nov. 4th as follows: "Your article in the *Journal of Radiology* on osteoporosis came at an opportune time as I had two cases under observation. One, an injury to the knee, showed osteoporosis four months after fixation in plaster, and the other a similar picture.

"Your suggestion of treatment is good, both patients are now walking

and have improved. I have watched the development under mobilization, in fact the more I mobilize the worse the condition."

Quite recently Dr. Hoke of Atlanta sent an x-ray and a history with a possible diagnosis of tuberculosis of the knee. The x-rays show the diffuse osteoporosis of all the bones of the knee joint and in the few weeks since mobil-

ization was discontinued and the patient urged to walk, pain is disappearing and function is returning.

I urge all who see cases of this kind to take an x-ray picture of all the joints. In all of my cases so far investigated the ankle joint on the involved side had the same picture of osteoporosis as the affected knee. This would exclude tuberculosis.



Figs. 7 and 8 (Case 2, Pathol. No. 23881)—Antero-posterior views of normal and affected knee four years after onset.



Figs. 9 and 10 (Case 2, Pathol. No. 23881)—Lateral view of normal ankle and ankle on the affected side four years after onset.

Figs. 11 and 12 (Case 2, Pathol. No. 23881)—Antero-posterior views of ankle on normal and affected side four years after onset.

EDITORIAL

The JOURNAL OF RADIOLOGY

A Journal of Ideas and Ideals.

Published monthly at Omaha, Nebraska, by the Radiological Publishing Company for The Radiological Society of North America.

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ANNUAL MEETING

Hotel Statler, Detroit, Michigan

December 4, 5, 6, 7, 8, 1922

Program Annual Meeting

TUESDAY MORNING—DECEMBER 5TH

- 9:00—"Report of An Unusually Interesting Case"—Howard T. Plank, M. D., Chicago.
9:25—"X-ray Study of Children's Lungs"—John McRae, M. D., Ashville, N. C.
9:50—"Lung Abscess"—Le Roy Sante, M. D., St. Louis.
10:15—"Congenital Partial Giant Growth"—W. E. Hart, M. D., Decatur, Ill.
10:40—"X-ray Study of Children's Lungs"—John McRae, M. D., Ashville, N. C.
11:05—"Tuberculous Bone Lesions"—Currie J. McMillan, M. D., Winnipeg, Canada.
11:30—"Further Observations on the Use of the X-ray in Mastoid Diagnosis"—Isaac Gerber, M. D., and F. Nolton Bigelow, M. D., Providence, R. I.

TUESDAY AFTERNOON—DECEMBER 5TH

- 1:30—"Practical Problems in Administering High Voltage X-ray"—Robert H. Millwee, M. D., Dallas, Texas.
2:00—"Essential Differences in the Technique Between Superficial and Deep Radiation Therapy"—Henry Schmitz, M. D., Chicago.
2:30—"Combined Surgical and Radiological Treatment of Cancer of the Breast"—Rollin H. Stevens, M. D., Detroit.
3:00—"The Relative Value of Unfiltered Radium Emanation in Deep Therapy"—Douglas A. Quick, M. D., New York.
3:30—"The Practical Application and Technique of the Higher Voltage X-ray Radiations, with Special Reference to the Advantages of the New Form of Apparatus Employed"—E. C. Ernst, M. D., St. Louis.
4:00—"The Radiation Treatment of Hodgkin's Disease with Reference to Mediastinal Involvement"—A. U. Desjardins, M. D., Rochester, Minn.
4:30—"Is Treatment of Cancer with Radio-Active Substances a Failure?"—Emil Ries, M. D., Chicago.
5:00—"A Discussion of Untoward Results in Deep

Roentgen Therapy"—James T. Case, M. D., Battle Creek, Mich.

TUESDAY EVENING—DECEMBER 5TH (8:00 P. M.)

Joint Meeting Wayne County Medical Society
"The Roentgenologic Signs of Colonic Cancer"—Russell D. Carman, M. D., Rochester, Minn.
A. J. Ochsner, M. D., Chicago.

WEDNESDAY MORNING—DECEMBER 6TH

- 9:00—"Multiple Peptic Ulcers"—Milton M. Portis, M. D., and Sidney A. Portis, M. D., Chicago.
9:25—"Gastro-Intestinal Foci of Infection in Chronic Deforming Arthritis; Radiological Study of Two Hundred Cases"—L. J. Carter, M. D., Brandon, Canada.
9:50—"The Four Projection Examination of the Nasal Accessory Sinuses"—Edward S. Blaine, M. D., Chicago.
10:15—"Roentgen Analysis of the Right Diaphragm in Health and Disease"—Edward H. Skinner, M. D., Kansas City, Mo.
10:40—"Diaphragmatic Hernia; Non-Traumatic, with Report of Four Original Cases"—E. H. Kessler, M. D., St. Louis.
11:05—"The Relative Value of X-ray Evidence in the Diagnosis of Duodenal Ulcer"—C. D. Enfield, M. D., Louisville, Ky.
11:30—"Sinus Disease and Lung Infections"—H. Kenyon Dunham, M. D., and H. John Skavlem, M. D., Cincinnati, Ohio.

WEDNESDAY AFTERNOON—DECEMBER 6TH

- 1:30—"Gleanings from a Medical Scrap Basket"—Truman Abbe, M. D., Washington, D. C.
1:55—"Relation Between Surgery and Radiation Therapy"—Burton J. Lee, M. D., New York.
2:20—"X-ray Therapy of Cancer"—E. L. Jenkinson, M. D., Chicago.
2:45—"The Therapeutic Uses of X-rays Other Than on Malignant Growths"—William L. Ross, M. D., Omaha.
3:10—"The Importance and Necessity of Minimizing Diagnostic Errors by Repeated Roentgen Examinations"—William J. Cassidy, M. D., Detroit.
3:35—"Objections to the Use of the 'One Lethal Dose Method' in Malignancy"—C. H. Nimms, M. D., Hot Springs, Ark.
4:00—"Pulmonary Abscess, Roentgenographically Considered"—William H. Stewart, M. D., New York.

WEDNESDAY EVENING—DECEMBER 6TH

- 8:00—"Roentgenological-Pathological Conference"—Preston M. Hickey, M. D., Detroit, and Aldred Scott Warthin, M. D., Ann Arbor, Mich.
8:45—"A Study of Irradiated Moles with an Attempt to Discover Histological Criteria of Irradiation"—James T. Case, M. D., Battle Creek, Mich., and Aldred Scott Warthin, M. D., Ann Arbor, Mich.

THURSDAY MORNING—DECEMBER 7TH

- 9:00—"The Progression of the Chest and the Determina-

- tion of the Normal"—W. W. Wasson, M. D., Denver.
- 9:25—"The Importance of Oblique Films in the Study of the Thorax"—James S. Pritchard, M. D., Battle Creek, Mich.
- 9:50—"Radiography in the Examination of the Urinary Tract"—C. G. Sutherland, M. B., Rochester, Minn.
- 10:15—"The Relationship of Roentgenology to Urology"—John R. Caulk, M. D., St. Louis.
- 10:40—"Radiological Signs of Endocrine Disorders"—William Engelbach, M. D., St. Louis.
- 11:05—"Some Organization Problems and Possibilities"—Warner W. Watkins, M. D., Phoenix, Ariz.
- 11:30—"Surgery and Radiotherapy, An Indispensable Combination"—Paul Eisen, M. D., Detroit.
- THURSDAY AFTERNOON—DECEMBER 7TH**
- 1:30—"The Effects of X-ray on Gastric Secretions"—Andrew C. Ivy, M. D., B. H. Orndoff, M. D., and A. Jacoby, M. D., *Dept. of Radiology and Physiology, Loyola University, Chicago.*
- 2:00—"Further Studies in Radiation Doses"—Francis Carter Wood, M. D., New York.
- 2:30—"Twentieth Century Advances in Cancer Research"—Erwin F. Smith, Sc. D., *Chief of Laboratory of Plant Pathology, Bureau of Plant Industry, U. S. Dept. of Agriculture.*
- 3:00—"The Roentgen Ray in Gynecological Cases. A Clinical Study"—Elizabeth M. Hanks, M. D., Chicago.
- 3:30—"Carcinoma of An Aberrant Thyroid"—A. F. Tyler, M. D., Omaha.
- 4:00—"The Operation of High Voltage X-ray Tubes"—W. D. Coolidge, Ph. D., Schenectady, N. Y.
- 4:30—"The Retardation of Tumor Growth by Pregnancy"—Maude Slye, Ph. D., Chicago.
- 5:00—"Measurements of Radiation from American Deep Therapy Machines, with Special Reference to the Duane Method of Measurements"—George E. Pfahler, M. D., Philadelphia.
- FRIDAY MORNING—DECEMBER 8TH**
- 9:00—"Pericarditis with Effusion"—Fred M. Hodges, M. D., Richmond, Va.
- 9:25—"A New Technique for the Positive Identification of the Sphenoid and Ethmoid Cells"—Amedee Granger, M. D., New Orleans.
- 9:50—"Roentgen Diagnosis of Lesions of the Maxillary Bones"—Kurt H. Thoma, D. M. D., Boston.
- 10:15—"X-ray Evidence of Sacro-Iliac Pathology"—Preston M. Hickey, M. D., Detroit.
- 10:40—"The Radiability of Gall Stones, Based Upon a Study of a Series of Surgical Cases"—Leon T. LeWald, M. D., New York City.
- 11:05—"Diagnostic Errors Disclosed by Bismuth Paste Injections"—Emil G. Beck, M. D., Chicago.
- 11:30—"The Differential Diagnosis and Treatment of Central Lesions of Bone"—Joseph Colt Bloodgood, M. D., Baltimore.
- FRIDAY AFTERNOON—DECEMBER 8TH**
- 1:30—"Comparison of Measurements of Intensity and Hardness of X-ray Produced by Different Types of American Transformers"—Albert Bachem, Ph. D., Chicago.
- 1:55—"The Design of Potter Bucky Diaphragm Grids"—R. B. Wilsey, Ph. D., *Research Laboratory, Eastman Kodak Company, Rochester, N. Y.*
- 2:20—"General Considerations in the Application of Radium"—William H. Cameron, M. D., Pittsburgh.
- 2:45—"Radium in Sarcoma"—H. B. Aiken, M. D., Toronto, Canada.
- 3:10—"Toxic Thyroid with Physiological Findings After Radium Treatment"—R. E. Loucks, M. D., Detroit.
- 3:35—"Radiation Therapy in Advanced Malignancies"—C. A. Donaldson, M. D., Minneapolis, Minn.
- 4:00—"The Effect of Radium and X-ray on Live Malarial Plasmodia"—Leon J. Menville, M. D., New Orleans.
- 4:25—"The Essence of the Action of X-rays and Rays of Radium on Cells"—E. Pohle, M. D., Frankfurt, a.M., Germany.
- 4:50—**CASE REPORTS**—Carl C. Birkelo, M. D., Detroit.
- 1—Calcification of the Kidneys, with No History of Tuberculosis.
 - 2—Classification of the Visceral Pleura.
 - 3—An Extensive Atrophic Arthritis in Both Feet.
 - 4—Bilateral Calculi in the Fallopian Tubes.
 - 5—Congenital Dislocation of the Hip Joint with Large Exostosis of the Neck of the Femur Extending Into the Acetabulum.

The Profession and the Public

DR. DESJARDINS in the October issue of the Journal touched upon one phase of the relationship of medicine to the public and in the November issue another phase was discussed.

This number deals with the fundamental principle of cooperation of the individual medical man with his professional brothers and with the lay public.

It is necessary in any discussion of this relationship to get certain fundamental facts in mind, and among these is the truth that medicine includes all phases of the healing art. Whatever has to do with the prevention of disease, the treatment of the sick and the promotion of euthanasia is included in the practice of medicine. This viewpoint was established long ago in the older civilizations of European countries, but in our newer country, with its consequent bourgeois thinking, such definite conclusions have not been reached.

Early in the history of the United States the profession of medicine became split up into several schools, due to a difference of opinion regarding certain therapeutic methods. For a time these various schools flourished. During their period of affluence they fought each other bitterly. In more recent years medical men have realized that this division of their own ranks has led to confusion of thought on the part of laymen and has, at the same time, weakened the ranks of the profession itself. So at the present time we hear little or nothing about allopaths, homeopaths and eclectics, but the medical profession is spoken of as a unit.

We are still beleaguered by a host of therapeutic enthusiasts such as the osteopaths, chiropractors, Christian Scientists, etc. That many of these advocates of certain forms of therapy have realized their mistaken viewpoint is evidenced by the fact that they have begun to raise the standard of requirements for the practice of their art.

The osteopaths have in recent years lengthened their course of instruction to four years, and even advise one year internship before actual practice. This is a great step in advance of two courses of a few months each, which was at one time all that was needed.

The chiropractors in Nebraska are now in a bitter fight among themselves, due to a difference of opinion as to the necessary requirements for licensure. One group thinks that the present requirements are good, but advises making them better. The other group is struggling to make the requirements for licensure even lower than they now are.

The Christian Scientists, so far, have eluded the necessity of license to practice. They just do it anyhow. We frequently think of the truism of Mr. Dooly, who said some years ago: "If the Scientists had a little more science and the doctors a little more Christianity, it wouldn't make much difference which you had so you had a good nurse." There is good philosophy in this jest.

The sum and substance of it all is that a broad viewpoint on the part of the medical profession is necessary to meet the thought of present day laymen. Tolerance, coupled with recognition of the fact that laymen want medical information, will bring the best results.

Ample evidence of the thirst of laymen for medical knowledge is everywhere at hand. This paper is being written while preparation for "Cancer Week" is under way, so that illustration forces itself upon us. Many medical men will testify that the whole population of the town, from children in arms to white haired, feeble, old men walking with canes, come to hear about cancer. The schools are dismissed that the children may learn, the women's clubs come in a body, the sewing circles and the men's clubs all turn out to hear and sit with rapt attention through the whole demonstration.

This attitude of the public toward medical facts makes one thing very clear, namely, that the profession itself has been derelict in its duty to the public. Quacks will always be among us, but when medical facts are known to the layman who will deny the deterrent effect which his action then will have upon the unscrupulous members of the profession?

The practice of medicine is still a personal service, and honest, well informed and well directed service will ultimately bear fruit. Backbiting and jealousy should have no place in the make up of the physician. The majority of physicians have the confidence of their constituents. They are still consulted about many things not definitely medical in character. Laymen have a right to this sort of knowledge and justly look to the medical profession for it. Because this is their right, and because every man has a right to exercise his franchise, the people will be the ultimate judges as to what shall be the status of the medical profession in the commonwealth.

The medical profession as a whole, then, and the individual physician in particular, has a great opportunity, but this opportunity brings with it a great responsibility. Either the medical man must meet this responsibility or "be weighed in the balance and found wanting."

That the outstanding members of the medical profession see this responsibility is amply proved by glancing through current medical literature. To quote from Dr. John M. T. Finney, *Annals of Surgery*, September, 1922, in an article entitled "The Opportunities and Responsibilities of the Surgeon": "One has but to look around in our own country, as well as abroad, to see on every hand evidences of social unrest and mutual distrust between classes and nations. * * *

In such a crisis as confronts us at this moment, to whom is society to turn for aid and guidance? From what other source can a satisfactory solution of its manifold and perplexing problems be found than from its educated, thinking men? We, as members of this favored class, to whom much in the way of opportunity has been given, owe much to society in return. In a strictly professional way we may have fulfilled this responsibility, some perhaps in large measures. But in the still larger sphere of good citizenship, of sharing in the responsibilities of the government, of making our influence felt upon the side of civic righteousness, we have, as individuals, or as a profession, little to show in the way of accomplishment. We must plead guilty to the charge frequently made against us, namely, lack of interest. In response to a fine professional

conscientiousness, overjealousy guarded, perhaps, we have stood too long aloof from active participation in public affairs, and have left to others, not always so disinterested, the management of civic matters, of great importance to us as individuals, to the communities in which we live, and to the nation. * * * Yet all the while we are deploring existing conditions and the lack of intelligent public opinion which would render such things impossible. Physicians should exert their moral force by actively interesting themselves in municipal, state, national and international affairs, not casting precedent entirely to the winds, but, on the other hand, not so firmly bound by it as to prevent them taking their proper place in society and accepting and discharging their full share of the responsibilities of citizenship. * * *

Those physicians and surgeons will do most to promote the advance who first do the best practical, technical work of which they are capable, and, secondly, exert their influence, wherever possible, toward the better organization of society as a whole. * * * There are many problems now engaging national and international attention in the solution of which the medical profession could render service of incalculable value to mankind. The weight of its united opinion could, for instance, satisfactorily determine the settlement of public health measures now under consideration, for example, the supervision and control of food supplies, urban and rural sanitation, child, school, personal, social and industrial hygiene, to which may be added many kindred subjects that affect community life."

There is indeed a heavy responsibility laid upon the medical profession. It is necessary to keep the vision clear, the face forward and the head erect to meet such a demand. Only by cooperation with other members of the profession and with the laymen in each community, can the greatest good be gained for the individual physician, for the profession as a whole, and for the commonwealth.

Medical Research

A COMPARISON of the medical literature of fifty to one hundred years ago with that of the present day furnishes convincing proof of the evolution of medical practice. Particularly noticeable is the increasing recognition of the importance of scientific research in its relation to medical science. Medical practice half a century ago was looked upon as an art. Today it is recognized that the practice of medicine is a science humanized by artful application to the human family.

It is probable, therefore, that much of the carping of some of the medical litterateurs is the natural result of the development to which reference has just been made. It is easily understood how the man who looks upon the practice of medicine strictly as an art should cavil at the exactions of medicine as a science.

But it seems safe to assume that no matter how much one may refuse to sanction the change, it has progressed too far to be abandoned or refuted willy nilly. Wherefore, it seems neither wise, nor in keeping with an honest regard for the large responsibilities impressed on scientific research as applied to medicine by a complex social order, to deny or try to evade the value of concerted and organized effort. Such a mental attitude is in effect to assume that science is not susceptible of discipline, which, if it were true, would be to say that science is an empty shrine more deceptive and hopeless in its professions than the professions of the most fatuous of religious dogmatists.

There is nothing to controvert, and everything to support the view that organized science, in medicine as well as elsewhere, will prove the greatest achievement in the history of the world's progress. As it would also seem to be indisputable that such an accomplishment would prove stimulative

rather than perversive of that intensity of individual effort deemed so essential to science and scientific research.

Organization of individual effort, whether applied to scientific research or to other lines of human endeavor, has already proven its worth. And it hardly seems open to question that such a schematic way of attacking the many problems to which the human family is demanding answer will clarify rather than add to the jumble and jargon of strict individualism. It will, to say the least, provide a check of practicality and bridle that desire for fame which leads many to the publication of reputed scientific findings before proper grounding has been established.

For this, if no other reason, the medical profession by and large should actively support scientific research. Reduced to a purely selfish statement, the medical profession will have before many years to meet the present trend intelligently, recognize its powers for good, and make the utmost of its possibilities, or be trod under the unsympathetic heel of public opinion.

The practitioners who are devoting their attention to the science of radiology are today pressed by many questions which must sooner or later be scientifically determined. Two fundamental propositions must be admitted: (1) that these questions will not be taken up and studied seriously until there is an apparent sincerity of desire on the part of radiologists to find the answers; and (2) that research workers undertaking the solution of these problems must have tangible and visible means of sustenance in order that the flower of their thought and the consummate degree of their energies may be given wholeheartedly to the problems in hand.

Iowa X-Ray Club

THE IOWA X-RAY CLUB met at Boone, Iowa, October 4th, at which time a program was held and the following officers were elected:
 President BEN T. WHITAKER, M. D., Boone, Ia.
 Vice-Pres. J. R. CHRISTENSEN, M. D., Eagle Grove, Ia.
 Secretary D. M. GHRIST, M. D., Ames, Ia.

A Contribution By Queen's University

QUEEN'S University, at Kingston, Ontario, Canada, has for quite a number of years embodied in its regular curriculum a course in the physics of x-rays and x-ray apparatus. That institution, it will be recalled, is one of the oldest and most reputable universities on the North American continent. The knowledge and experience it has gained in this phase of radiology is not only authentic but valuable.

The Journal feels greatly pleased, therefore, to be able to announce to its readers that, beginning in an early issue, it will present a series written for it exclusively by John K. Robertson, Ph. D., of the Physics Department of Queen's University, dealing with the physics of x-rays and x-ray apparatus. The series will, of course, be prepared primarily for medical men, and, in order that the subject may be treated exhaustively and represent an authoritative treatise, only an elementary knowledge of physics will be assumed.

Various phases of importance will be discussed. For example, the interrupterless transformer, measurement of high voltage, induction coil, high frequency, origin of x-rays, action of the gas bulb, regulation of vacuum, the Coolidge tube, the nature of x-rays, kinds of x-rays, penetrometers, secondary rays, dosage, etc., will be considered in the belief that much of the present confusion will be eliminated.

From the preliminary sketch of this series which has been submitted to the editor, he has no hesitancy in saying that this will be a very valuable, instructive, and interesting discussion of the physical side of the science of radiology—a phase which is of basic importance to every person using x-rays either therapeutically or diagnostically.

A New Radium Enterprise

LATE press dispatches contain information which is more than passingly interesting with respect to the world radium market. On November 13th last, according to the New York Times, at a meeting held in the Colonial Museum at Brussels, under the auspices of the Societe Generale du Belgique, with King Albert of Belgium and five hundred distinguished guests present, including among the latter, state dignitaries, scientists and representatives of the medical profession, formal announcement was made confirming the rumors of the discovery of high-grade radium ore deposits in the Belgian Congo of South Africa.

It will be remembered that rumors of this discovery have been rife since 1913. The announcement continued to the effect that extensive investigation has been made into the quantity and quality of the deposits in question and that as a part of that work large quantities of the ore have been transported to Belgium for testing.

The results withal have been so satisfactory that a large reduction plant has been constructed and is now in operation at Oolen, Belgium. The plant is said to be by far the largest of its kind in the world, with a capacity exceeding the combined output of all American reduction plants of this type.

The carnellite ore deposits of Colorado have heretofore been considered the most valuable productive radium deposits in the world. The fact is several of the largest American radium concerns have depended entirely on the Colorado mines.

Because of America's experience in the mining and marketing of radium products, and due to the present condition of European finances, the Societe Generale du Belgique has solicited American counsel and aid in the development of this enterprise. As a consequence, a joint corporation has been created between the Belgian interests and The Radium Company of Colorado, which will be known as the Societe Generale du Radium. The press dispatch referred to earlier in this discussion is authority for the statement that this joint corporation will market the products of the Oolen plant all over the world. In the United States the business of this joint corporation will be conducted through The Radium Company of Colorado, which has exclusive sales rights in America of the Belgian products. It is understood that the Colorado Company will temporarily, if not permanently, discontinue the mining and refining of Colorado ores.

Representatives of the executive and technical staffs of The Radium Company of Colorado have been in Belgium since last July bringing to the satisfactory culmination already indicated the numerous details and technical problems inherent in the launching of such a vast undertaking.

According to the information given out, it is proposed to ship the entire output of the Belgian plant to the United States, where it will be distributed in suitable containers for therapeutic application. The closest sort of cooperation will be maintained with the United States Bureau of Standards and the latter will be commissioned to certify all of the radium salts offered for sale.

DEPARTMENT of TECHNIQUE

Drawings for Lantern Slide Protection

N. J. NESSA, M. D.

Sioux Falls, S. D.

Take an ordinary Eastman dupli-
tized film and pass it through the fixing
bath until the silver salt has been re-
moved, wash and dry. This will leave
a clear, transparent film with enough
emulsion base remaining to hold writ-

ing. In drawing, your diagram can be
treated directly on the film on squares
the size of standard lantern slides—
($3\frac{1}{2} \times 4$ inches)—which now can be
mounted or placed between two hinged
covered glass slides and projected in

the ordinary lantern glass adhesive
paper along one side. This method of
mounting can also be used for small
objects such as radiographs of fingers,
etc. India ink gives best results for re-
production.

Dr. Albert Soiland's Installation

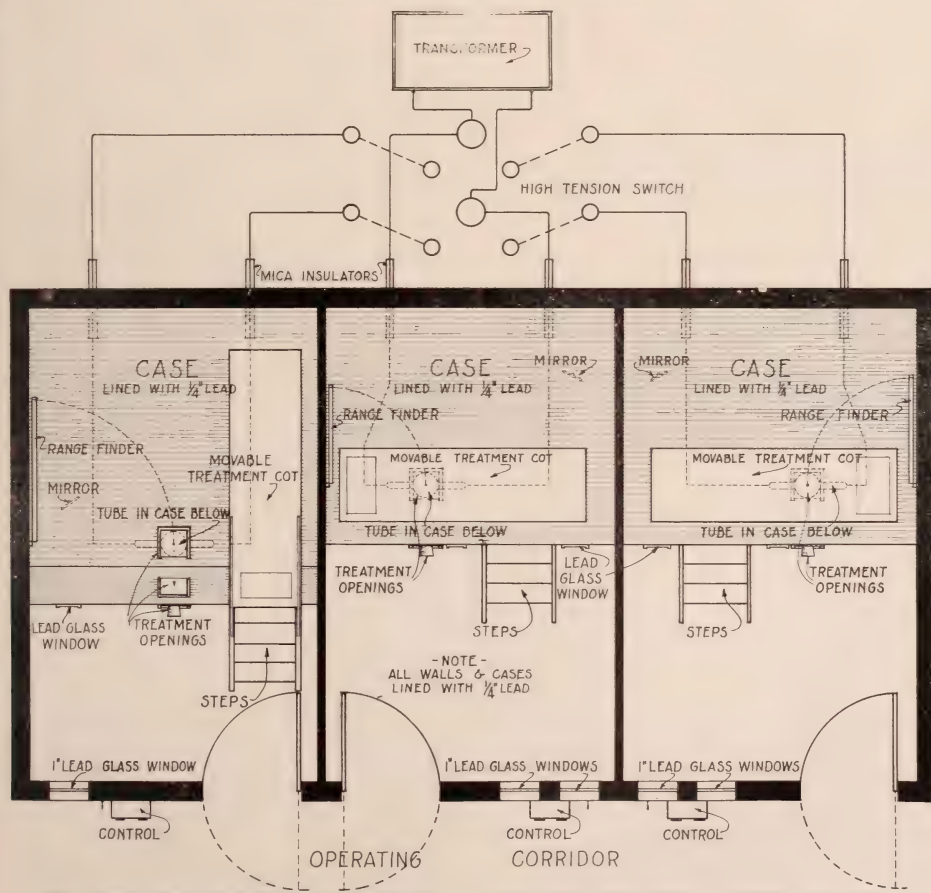


Fig. 1—High voltage installation of Dr. Albert Soiland, Los Angeles, showing connection for operating

three tubes, either singly or multiple, from same generator set.

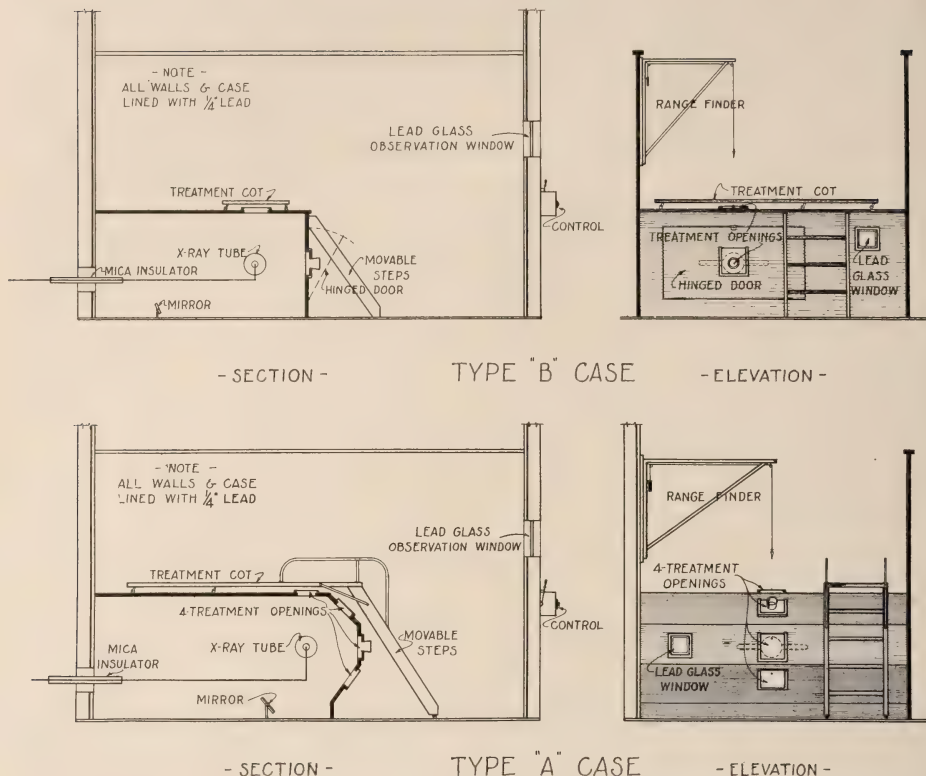


Fig. 2—Front and side elevation of tubes and tube

holders, with accessory devices.



Fig. 3—Section of operating hall, showing high tension switches and voltage control.



Fig. 4—Treatment booth in lead lined cabinet.

CASE REPORTS

Carcinoma, Originating in Porokeratosis, Successfully Treated by Roentgen Rays

H. H. HAZEN, M. D.
Washington, D. C.

THE FOLLOWING case report is of special interest for three reasons. First, because the disease is an extremely rare one, not more than 60 cases have been reported in the literature; second, because this is the first recorded case where cancer has developed from porokeratosis; and third, because cases of prickle-celled cancer with gland involvement successfully treated by the roentgen rays are rather unusual.

In 1892 porokeratosis was first described simultaneously by Mibelli⁽¹⁾ and Respighi⁽²⁾. The best articles concerning this condition have been published by Hutchins⁽³⁾, Heidingsfeld⁽⁴⁾, Respighi and Ducrey⁽⁵⁾, Matsumoto⁽⁶⁾ and Wright⁽⁷⁾. These articles contain a complete bibliography. Practically nothing is known as to the causation of the disease; although Wende⁽⁸⁾ probably succeeded in reproducing a lesion by autoinoculation. Gilchrist⁽⁹⁾ has reported 11 cases occurring in the same family and other writers have noted an hereditary tendency. The disease usually develops upon the backs of the hands, but may develop upon other portions of the body, especially the feet. It begins as a small lesion that resembles a keratosis. There may be one spot or there may be a number. After a considerable space of time there is peripheral extension so that round or roundish areas as much as two or three inches in diameter may be formed. They are sharply circumscribed by a raised, dark, horny edge and have a more or less atrophic center. The lining wall is very irregular in outline and through its center there is often a depression that may contain concretions. As a rule there are no subjective symptoms, but itching has been noted.

Pathologically the disease probably is a nevus. Histologically there is an early acanthosis and inflammatory changes in the corium. Later there is a hypokeratosis with plugging of the follicles and sweat ducts.

It is usually conceded that the curet and cautery are not effectual. Apparently light x-ray treatments have likewise failed. Gilchrist reports good re-

sults from excision or the use of the electric needle.

REPORT OF CASE

The patient first came under observation October, 1920, complaining of a sore hand. He was a native American from a small town in Virginia, where he was engaged in the trucking business. He was 60 years of age and according to his history he had had trouble with his hand for 30 years, but only during the past three months had it been really bad. There was no history of any similar disease in his family. His personal history was negative except that he had been much exposed to the sun. The condition of the hand at this time is well shown in the accompanying photographs from a cast made by Captain

Wallis, of the Army Medical Museum. For these photographs I am indebted to Major James F. Coupal, acting Curator of the Medical Museum. Upon the dorsal surface of the hand was a raised edge, enclosing an atrophic area nearly three inches in diameter. The skin over this area was glazed, stiff, and reddened. In it were a number of small firm nodules. Just within the horny edge were three separate nodules each about one centimeter in diameter. Upon the fingers were a number of small keratotic-like areas from one-half to two cm. in diameter. Several of these contained firm, hard nodules similar to those already described. The condition upon the palm of the hand showed a slight amount of keratosis



Fig. 1.—Dorsal aspect of the hand, showing the large area of skin involved in porokeratosis; also the three nodules within this area which had undergone malignant degeneration.

Fig. 2.—Palmar aspect of the hand, showing extensive area of porokeratosis.

surrounded by a typical dike wall so characteristic of porokeratosis. The epitrochlear gland was about two centimeters in diameter. The axillary glands were considerably larger, both had the characteristic "feel" of cancerous glands.

The blood Wassermann was negative. Tissue removed by a cutaneous punch from the larger nodule showed prickle-cell cancer with a fair number of epithelial pearls. This type of cancer it will be remembered has been shown by McCarthy, of the Mayo Clinic, not to be so malignant as prickle-cell cancer without pearl formation. But, as the patient refused to consent to the extensive operation deemed necessary it was decided to try radiation. The first treatment was given October 28th, with the following technique: no filter, F. S. D. 9 inches, ma. 4; spark gap, $7\frac{1}{2}$; time, two minutes and fifteen seconds. A treatment with the same technique except that it was but forty-five seconds long was given

to the palm. The following day the axillary and epitrochlear areas were radiated through 1 mm. Al, $8\frac{1}{2}$ inch gap and 4 ma. for five and one-half minutes. November 15th the same treatment was given except that the gland areas were radiated through 2 mm. Al. for six minutes. Following this treatment the atrophic areas on the dorsal surface of the hand broke down giving an area of healthily looking granulation. By December 6th this had healed in and the same treatment was repeated. On December 27th the hand had healed and all nodules had completely disappeared. The lymph nodes were treated upon this date and again on January 13th, 1922, January 31st, February 20th, March 18th and April 29th. Upon the last mentioned date the back of the hand was entirely well and the enlarged nodes had completely disappeared, but the one treatment on the palm had no effect upon the porokeratosis. Upon the back of the hand the dike wall had completely

disappeared as the result of heavy treatment.

In September, 1922, this patient was entirely well without any evidence of malignancy.

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Hematoma of the Gastrohepatic Omentum: X-Ray Plate Suggestive of Carcinoma of the Stomach

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THE FOLLOWING case, sent to our clinic for diagnosis and treatment, brings out the fact that a thorough fluoroscopic examination is important before any positive conclusions are drawn, even though a number of plates may have been made and the same constant defect noted. Nor must we omit the history of the case in the elimination of certain possibilities. The x-ray is only an adjunct to diagnosis when all the findings are brought together.

This case pointed to a history of pathology in and around the stomach, and here the symptoms were confined to the upper left hypochondriac region. Because of extreme tenderness over this area and a spastic condition of the abdominal muscles the physical examination was not very satisfactory. Urinalysis gave negative findings. Blood examination showed 9,000 white count with delayed coagulation test. The first physician called to see the case had rendered a tentative diagnosis of perforated gastric ulcer.

HISTORY

Mrs. E. H., age 32 years, married 11 years, no children or miscarriages. Father and two brothers living, one brother died in infancy from pulmonary tuberculosis, and a sister died in infancy, cause of death unknown.

The patient has had measles, mumps, whooping cough, chicken pox, pneumonia, typhoid, influenza, tonsillitis and

rheumatism. Menstruation began at the age of 15, periods are of three days limitation and painful at first. In 1913 the patient had a curettage, and also a dilatation of the cervix for sterility.

Present Complaint: Pain in the left hypochondriac region, abdomen very tender, inability to lie on the left side. On March 16th, 1921, after eating a heavy evening meal, patient had a distressed feeling in the stomach with slight nausea but no vomiting. A cathartic was taken and the bowels moved, giving some relief. On the following

morning, after partaking of a little breakfast, the pain became more intense and continued all day. In the evening a physician was called, who gave her opiates, which brought relief temporarily, but the pain continued when the effect of the morphin passed off. The following day found the patient in a more prostrated condition, as the pain had returned with greater severity. The abdomen was very tender and the bowels had not moved in twenty-four hours, due perhaps to the effects of the opiates.

It was then that the patient was brought to the hospital, with a temperature of 99 and a pulse of 100. Respiration count was 22. When she arrived at the hospital after a 40 mile ride in an automobile she required support to stand for the fluoroscopic barium meal examination. The second day in the hospital she showed a normal temperature, but in the evening it had returned to 99.6. On the morning of the third day the temperature was normal, but the pain and tenderness still existed. A few hours later she was operated upon.

ROENTGEN FINDINGS

The fluoroscopic examination showed a partial hour glass contraction of the stomach in its mid-portion, with absence of peristaltic waves over this area. There was a ragged appearance on the greater curvature. The remain-



ing part of the stomach was markedly spastic. The duodenal cap could not be made to fill as there was spasticity at the pylorus. The position of the stomach was rather high in the epigastrium and could not be displaced, although the patient could stand a little pressure. This gave us a clue to adhesions holding the stomach high up to the left. As the patient could not lie on her abdomen plates were made in the upright position. These verified the fluoroscopic findings. A diagnosis was rendered of perigastric inflammation with adhesions. At first carcinoma was though present, but this was eliminated.

OPERATIVE FINDINGS

On the lesser curvature of the stomach in the midsection, in the gastro-hepatic omentum, was found a hematoma 3 by 5 cm. in area, with exudations of lymph and adhesions to the wall of the stomach. The adhesions were freed easily and the bloody mass was removed. No induration was present nor perforation of the gastric wall. The gall-bladder was negative. There was evidence of an old salpingitis, chronic pelvic inflammation, and the

appendix was adherent in the pelvis.

PATHOLOGICAL FINDINGS

In this tissue were found large collections of red blood cells and various forms of leukocytes. Many of these collections appeared to be enclosed within dilated blood vessels and sinuses. The tissue as a whole had somewhat the appearance of a hemangioma. One must not overlook the possibility of this tissue assuming the function of a blood making organ, a phenomenon that sometimes occurs in various forms of anemia.

COMMENT

Without knowing the clinical aspect of the case, it is quite evident that a diagnosis of carcinoma of the stomach would be suggested, since the plates showed some of the characteristics of this lesion. The pathological finding of a tumor mass (hemangioma) did not, in our opinion, eliminate a new growth, as hemangioma comes under the pathological classification of tumors. It was a tumor mass, but of extragastric origin. It was the adherence of the stomach in the upper left hypochondriac region when the patient was examined in the upright position that made us think that the pathology was not inside the stom-

ach wall. If the tumor were intragastric, the position of the stomach would have varied when external pressure was applied. The only finding which may have favored a diagnosis of intragastric tumor was the lack of peristaltic waves in the constructed area. Dr. Le Wald, in a recent interview on this subject, could only suggest syphilis in addition to carcinoma as a possible lesion. In his article on the "Leather Bottle Stomach" his description of the "Dumbbell Stomach" may show a slight resemblance to my plates, but the history of the case and fluoroscopic findings are not the same. His findings of dilatation of the duodenum with rapid emptying of the stomach, are reverse to my findings of spasticity of the pylorus and a ragged appearance of the greater curvature of the stomach with delayed emptying.

Whatever our opinions were in this case prior to the operation, we believed that the right thing had been done in subjecting the patient to an exploratory laparotomy, thereby giving her better prospects of recovery. The last report of the case stated that the patient was doing very nicely.



NEW EQUIPMENT

The DupleXray

THE ENGELN Electric Company in conjunction with the Kelley-Koett Manufacturing Company recently produced a new and unique x-ray plant which is known as the "DupleXray." This x-ray plant is being produced on a quantity production basis in order to keep the manufacturing cost low on a highly developed product which would ordinarily command a high selling price.

This radiographic and fluoroscopic x-ray plant consists of a transformer and control with the new K-K motor-drive tilt fluoroscopic table, which permits the movement of the table from the vertical to the Trendelenburg or any intermediate position by merely turning a switch. The table can also be moved to any position, independent of the automatic control.

The table is equipped with an accurately counter-balanced fluoroscopic screen carriage, which allows the screen to be moved both in the plane parallel to the table and perpendicular to the table. The additional feature of counter-balancing the carriage so that the screen will move up and down over the patient, allows the operator more freedom when reducing fractures. The K-K Tilt Table is the only fluoroscopic table having this decided advantage. The screen also has rotational motion on its own axis so that the various positions are unlimited.

This motor-drive tilt table is not only correctly designed for convenient fluoroscopy, but is arranged so that all radiographic work may be accomplished with minimum effort. The same counter-balanced carriage which carries the fluoroscopic screen, is arranged to take a specially constructed tube arm. The tube arm has the same complete range of motion as the fluoroscopic screen, besides permitting the tube to obtain the different angles desired.

In addition to the usual method of obtaining radiographs, the Engeln Electric Company have arranged a unique and practical method of taking radiographs during the fluoroscopic examination. With this arrangement the same Coolidge tube used for fluoroscopic examination takes the radiograph. A cassette holder is attached to the back of the fluoroscopic screen so that it is merely necessary to slide the cassette into position. The control is constructed to automatically obtain the correct milliamperage and back-up for radiography by merely turning the switch handle. This is accomplished in the dark without moving the patient. Fluoroscopy can then be continued, if desired.

The control cabinet for operating the DupleXray is mobile. This allows its placement in the most convenient position for radiographic and fluoroscopic work. The auto-transformer voltage selector is calibrated to indicate three, four and five-inch back-up settings. This calibration means

that no testing for the desired spark gap is necessary.

The well known Engeln High Tension Aerial Switch is used to obtain the high tension current to the tube stand over the table. It is mounted in the transformer cabinet and is controlled from either side. The high tension masts, extending 84 inches from the floor, are well grounded and insulated. Every part of the DupleXray is grounded where necessary so that full protection is assured. The entire construction of the DupleXray, indicating ease of operation, is naturally appreciated by the profession.

In addition to the very desirable electrical and mechanical features in the DupleXray it is very compact. This makes the problem of space for the installation a secondary consideration. Although the DupleXray is produced as a complete x-ray plant, the Kelley-Koett motor-drive tilt fluoroscopic table can be supplied separately, as it is especially adaptable to present installations.



Announcing an Intermediate Deep Therapy Machine

"SNOOK SPECIAL"

MORE than a year ago the Victor X-ray Corporation announced the Victor Deep Therapy Roentgen Apparatus, the first of its kind in this country, and with a capacity exceeding the requirements of any Coolidge therapy tube up to that time. In other

words, it was designed to handle the Coolidge tube of the future with higher voltage and greater milliamperage.

Those who have installed this Victor outfit are ready to use voltages higher than 200,000 just as soon as a Coolidge tube is developed for higher voltages, which will undoubtedly be in the

comparatively near future. These users will not find it necessary to re-equip in order to meet the increased requirements, for their present Victor machine is in anticipation of future developments.

There has been a persistent demand, nevertheless, for a smaller and lower priced machine with capacity limited to

200,000 volts—sufficient to energize the present Coolidge deep therapy tube—and which would also serve as a combination machine to include diagnostic service. It seems that many roentgenologists and institutions are content to confine their therapy work within 200,000 volts, for the present at least.

A new and intermediate model Victor Deep Therapy Apparatus is now available, with a maximum of 200,000 volts. This announcement is awaited by many roentgenologists who did not feel justified in making an investment in the larger machine when their plans did not take them beyond the 200,000 volt Coolidge tube of the present.

The development of this intermediate combination model began not long after the larger Victor machine was announced, in view of a possible demand for apparatus for deep therapy along the lines of the new technique and which could be utilized also for diagnostic work.

The rectifier, which is really the

heart of the machine, is of the well known "Snook" cross-arm type. All of the advantages of the principles of this type of rectifier have been utilized, but in addition marked improvements in the details of the essentials of construction have been worked out, making it far superior to any Snook type rectifier ever put out, in spite of its recognized superiority in its present day form, as exemplified in the standard Snook machine.

The machine will be put out in two models—one as a straight therapy machine, the other as a combination diagnostic and therapeutic machine, both having a maximum voltage rating of 200,000 volts peak value. So far as the current rating is concerned, the transformer supplied with this intermediate model will have capacity considerably in excess of that required for the present deep therapy tube.

The machine will occupy a space of from one-third to one-half that required for the Victor large 280,000 volt machine.

The significance of this announcement is that there are now two Victor deep therapy machines available. One, the original 280,000 volt machine with which not only the deep therapy Coolidge tube of the present can be used, but also tubes for higher voltages that are in the process of development. The other, the intermediate model now announced, with which any present deep therapy technique can be followed, the transformer having a current rating ample for Coolidge tubes of higher current capacity than the present, at 200,000 volts.

The larger machine is, needless to say, the logical selection where the intention is to use, as soon as possible, with the newer deep therapy technique, the higher voltage tubes of the future. On the other hand, the "Snook Special" combination deep therapy diagnostic machine meets the requirements of all deep therapy technique up to 200,000 volts and can be used also for radiography.

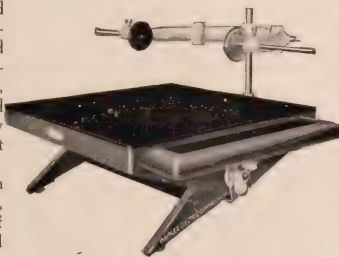
New Wappler Sinus and Mastoid Head Rest

THE CLINICAL importance and the technical difficulties of making correct examinations of the human head have for a long time justified the careful designing and working out of an adequate head rest. But because of the many different methods and techniques in use it has been a difficult task to develop a head rest which is applicable for all the various examinations of the head. However, for the examination of the frontal, the auxiliary and maxillary sinuses, definite methods of placing the patient's head upon the plate and adjusting the principal angle of the rays have been agreed upon, and similarly, for the examination of the mastoid cells and processes, definite positioning of the patient's head and directing of the rays have by agreement been found to give the best diagnostic roentgenograms.

A very useful head block has been designed by the Wappler Electric Co., based on these standard methods of examination, which is equally useful and adequate for the correct examination of the frontal and maxillary sinuses as well as of the mastoids.

In the illustration, this head block is shown with a head clamp, as it would be employed for immobilizing the head for the examination of the frontal sinuses. The desired angle of tilt can be adjusted with the clamping mechanism and scale, shown on the right side

in the illustration, which indicates the angles of tilt. The head clamp is wide enough and the prongs are such that the head can be held in all desirable positions whether in the anterior or posterior, that is, for the examination of the frontal and maxillary sinuses or in the lateral position for the examination of the sella, turcica, the dome of the skull, foreign bodies in the eye, examination of the mandibles, the cervical part of the spine, etc. For this pur-



pose the plate holder channel is placed in the head rest as close to the lower border as is feasible so that as many of the cervical vertebrae and as much of the neck can be included as the height of the shoulders will permit. For the examination of the lower jaw the head rest is tilted away from the pa-

tient, and a very convenient angle to eliminate super-position of the jaw above is obtained for the examination either of the lower or of the ascending ramus of the jaw in contact with the plate. For the examination of the mastoid processes, the head rest is tilted toward the patient to such an angle that the desired tilt of 15 degrees upward and of 10 degrees posteriorly, which gives the clearest outline of the mastoid cells and processes, is easily obtained.

The head rest has a bakelite top and the plate or film is as close to the patient as possible to avoid blurring and distortion of the fine bony structure. For stereoscopic work the plate or film holders can be removed either from the side or upward and the plates can be placed either in a horizontal or a vertical position, as the case may require. The head rest may also be employed for the stereoscopic examination of extremities and it is found very convenient to be able to tilt the platform slightly to bring the plate or film in close contact with certain parts of the body. It appears that the combination of a mastoid and sinus head rest is a very successful solution to create a rather universally applicable head rest which undoubtedly will be welcomed and prove a very useful appliance in every roentgen ray laboratory.

Acme Bedside Roentgen Unit

THE ACME Bedside Unit, which was first exhibited at the May, 1922, meeting of the American Medical Association, is of all metal construction, with the exception of insulating materials. No wood is used at any point. The unit is complete in every detail with the meters, timer, filament equipment and all control handles, perfectly insulated, mounted directly on the control board. This makes it possible to do any work up to the full capacity of the 5-inch 30 ma. radiator type tube with one small and compact unit which may be moved to the point of greatest convenience.

The high tension transformer is of the closed core oil immersed type, with a separate filament transformer suspended in the same tank. This construction permits the filament control to be kept in the low tension circuit, a very pronounced advantage. A method of winding the high tension transformers, new in roentgen work, but proven in commercial work, has been used, so

that magnetic leakage between primary and secondary is reduced to a minimum. In this way the high inverse current normally present when a self-rectifying tube is energized is cut down to a marked extent and the drop in secondary voltage with increase in load is also greatly reduced.

The control features of this apparatus are practically the same as those of the Acme 5-inch, 30 ma. unit and 85 kv. roentgen generator. Control of penetration is secured by means of a 20 point auto transformer. Measurement of penetration is obtained by means of a penetration meter calibrated from three to five inches. The filament current is controlled by an inductance regulator inserted in the low tension circuit and designed with a toggle action which gives practically uniform control of the current throughout its range. Measurement of the tube current is obtained by a milliammeter interposed in the secondary circuit of the transformer and carried at ground potential.

A timer mounted directly in the control stand can be provided for timing exposures. This piece of apparatus is equipped with electro-magnetic control. The exposure is set by means of a dial and is started by an electrical push-button at the end of a cable. If the button is kept depressed, the exposure will be automatically terminated at the end of the timer interval. It can, however, be stopped at any time necessary in case of an accident, etc. In this case the time will not go back to zero, but will remain set so that the balance of the exposure can be made if desired.

If the timer is not provided or is not used, the energization of the generator is usually controlled by means of a foot switch attached directly to the control stand. However, the push button and cable are also furnished, so that this method of control may be used when desired.

The foot switch, as well as the circuit controlling elements of the timer, are of the remote control type and do not themselves make and break the heavy currents required by the generator. A magnetic circuit-breaker in the control stand is controlled by these devices. This prevents in a great measure all the trouble from poor contact due to oxidized surfaces.

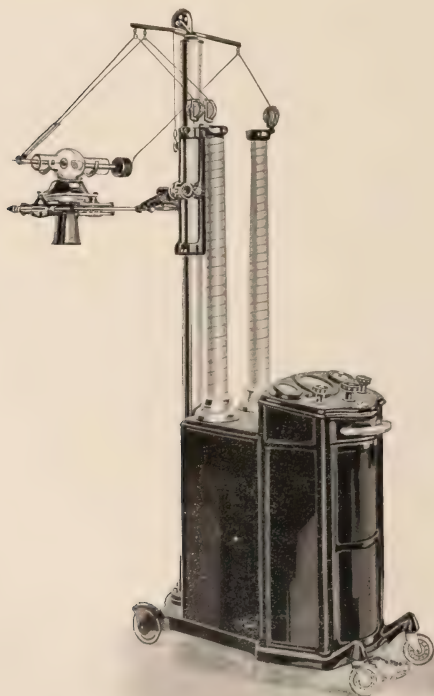
The safety of the operator, patient and apparatus is guarded to great extent by means of an overload circuit-breaker. This device is either operated by means of a button on the control panel or operates automatically if predetermined current is exceeded, as in case of sparkover.

The tube stand is of good mechanical design, giving all necessary adjustments and angles for bedside and portable work. It is equipped to hold a five-inch radiator type tube and is perfectly counterbalanced. Spring insulating terminals are attached to the upper end of the tube stand to keep the wires taut and clear of all conducting parts.

The high tension terminals are made throughout of insulating material capable of continuously withstanding the highest potentials used.

The cabinet housing the high tension transformer and its control parts is of all metal construction and is mounted on an iron base carried by large rubber tired wheels. This allows the entire unit to be moved from place to place with the greatest convenience.

The cabinet is finished in a two-tone black enamel. The tube stand is finished in black enamel, polished aluminum and nickel.



Victor "Truvision" Stereoscope

A STUDY of the principles of stereovision and its application in x-ray diagnosis, brings out the startling fact that while the effects which have been obtained were seemingly correct, the truth is that the manipulation of the illuminating factor, by which these brilliant effects were induced, served to defeat the very purpose of stereovision, so that instead of what was believed to be perfect stereovision it was illusion that actually prevailed.

The object of stereovision is to blend into one image two pictures of an object from slightly different points of view, so as to produce upon the eye the impression of relief—a true evaluation of depth. The value of this in x-ray diagnosis depends altogether on the degree of accuracy with which this effect is produced by the optical and mechanical facilities employed. If the stereoscope employed in the study of paired radiographs gives an impression of relief, from which to make deductions as to the relative depth of anatomic parts or foreign bodies, and which is not true to the conditions actually existing, then diagnosis can not be certain. With apparatus available up to the present, the roentgenologist has manipulated his source of illumination intending to bring out the maximum relief or stereoscopic effect, and in so doing has unwittingly obtained untrue evaluation of depth of the anatomic parts under study. He

has drawn on his imagination, to an extent, to bring out an effect.

The Victor "Truvision" Stereoscope was designed with a view to applying the essential principles of stereovision in a manner that insures the roentgenologist against "spurious" relief. This has been achieved through careful study by Victor engineers of all the factors involved, and extensive experimental work, reverting to the conditions under which the radiographs are produced, to determine their exact relation to a method for producing correct stereovision.

A radical departure is made from stereoscopes of previous design, in that only one light bulb is used in each viewing box instead of the usual four. This single 150 watt bulb, nitrogen filled and with a concentrated tungsten filament, is placed centrally in the viewing box.

From the fact that the distribution of light from this bulb corresponds very closely to the distribution of x-rays under which the radiograph is produced, that is, with the intensity greater at the central portion of the film and where the anatomic part under study is usually placed, this reproduction of conditions obviously gives the natural effect or true stereovision.

Compare this with the unequal distribution of illumination characteristic of the four-bulb viewing box. With

four sources of illumination there are four points of concentration, and, as the bulbs may vary in efficiency the effect would make diagnosis difficult, considering the composite nature of some radiographs.

Then again, the usual practice of placing a separate control for each viewing box has been abandoned in the design of the "Truvision" stereoscope. Instead a central rheostat control is used, with which the operator changes the intensity of illumination in the boxes simultaneously; each negative is therefore equally illuminated. A simple experiment will show that two sources of illumination unequal in intensity appear to the observer as though in different planes, which effect can be varied by increasing or decreasing the light intensity in either source. Logically, then, to avoid this in stereoscopy the illumination in the viewing boxes must be of equal intensity at all times. This is provided for in the "Truvision" stereoscope with the central rheostat control, each adjustment of which reacts simultaneously in both viewing boxes.

Protection of films against heat while mounted on the viewing box is assured, ample ventilation being provided through two vents, at top and bottom and immediately back of the diffused glass, running the width of the box. Consequently there is no accumulation of heat, and films or plates can be left on for any period of time, either wet or dry, without danger of sticking or affecting the emulsion. Incidentally, the ventilation serves also to prolong the life of the nitrogen bulb.

Fig. 2 shows how the entire optical bed can be raised or lowered, through a device in the vertical column, to accommodate the eye level of the observer, either standing or sitting. This feature is introduced for the first time in the "Truvision" stereoscope, and the advantage is at once apparent.

Note also in Fig. 3 that the optical bed can be mounted on the wall. This change from floor base to wall brackets can be made in a few moments. This provision can be taken advantage of in those instances where conservation of floor space is essential.

The all-metal construction (excepting the opaque water and heat proof curtains and the glass) makes the "Truvision" stereoscope durable in the broadest sense, and rigid, with nothing to warp. The drain-trough for wet negatives is of aluminum, so here, too, there is no possibility of rust or corrosion.



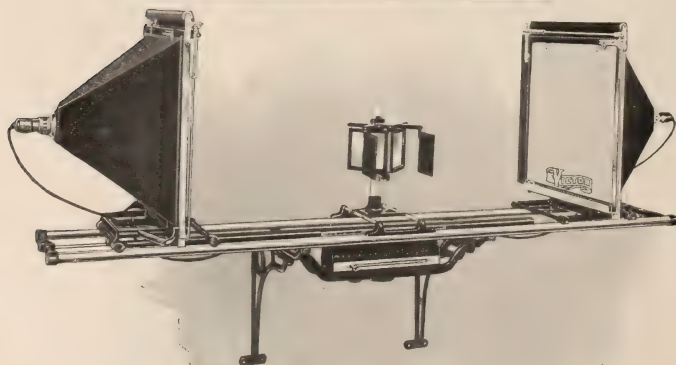
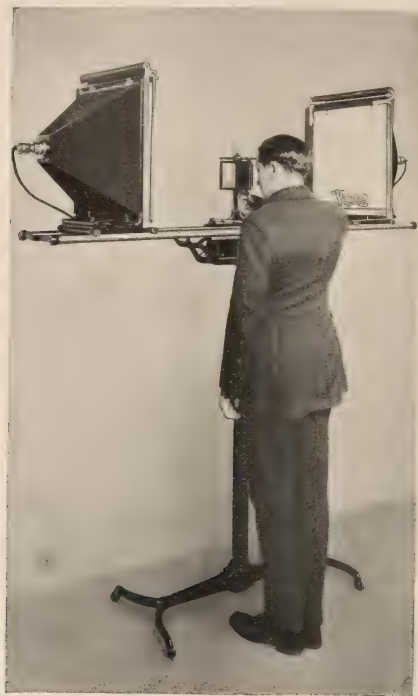
The mirrors can be adjusted to any angle required, simultaneously in either direction from the 45 degree angle, to right or left, or vertically for concentration on a certain area of the radiograph.

If desired the "Multiplex" attachment can be furnished, consisting of a second set of mirrors, so that two observers can view the same radiographs simultaneously. The second set of mir-

rors having adjustment features identical with the first, each observer thus independently accommodates his vision.

Another very interesting comparison of the "Truvision" stereoscope with the multiple lamp type is from the standpoint of economy. Considering that only two light bulbs are used on the former as against the usual eight in the latter, and figuring on the basis of average use of one hour per day for 300

days each year, the two 150 watt bulbs will consume 90 kilowatt hours of current; at the rate of 10 cents per kw. hour makes an annual cost of \$9.00. With the usual 8-bulb stereoscope consuming 800 watts per hour or 240 kw. hours, the cost annually will reach \$24.00. This means a saving of \$15.00 on current alone; the difference in cost for lamp renewals will increase this figure.



Kromayer Bedside Unit

FOLLOWERS of the principle of water-cooled quartz lamps, will find many advantages in the new Kromayer Lamp Bedside Unit, manufactured by the Hanovia Chemical Company.

This unit is called semi-automatic by its manufacturers. In response to a wide-spread demand for a Kromayer lamp sufficiently portable for use in hospital wards and also to avoid the necessity of special water connections where the lamp is used in several rooms in private practice, the Hanovia Company has perfected a semi-automatic outfit known as the bedside unit, illustrated herein.

The quartz burner is mounted on an adjustable arm, which possesses sufficient rigidity to hold the lamp firm when in use and still give almost universal adjustment motion.

The outfit is equipped with all necessary electrical regulation, built into a handsome white enameled table, large water tank for cooling the burner and circulating pump, which is operated by the lamp switch. By this arrangement, it is possible to light the lamp before the water has been turned on. The water flow is visible and cannot escape attention. The tank contains an ample

water supply to avoid heating even in continuous operation, and is provided with a small stopcock for draining off the water when desired.

The tank is also equipped with a visible float, which serves as a water gauge, and shows at a glance whether the tank is properly filled. The tank

is made of solid copper and will not rust.

In the side of the table is a commodious drawer divided into compartments for the various shaped applicators, which are, therefore, kept always handy and the table top is furnished with a ribbed rubber mat, removable for sterilization, to receive the instruments, etc., in use.



Agfa

AN ANNOUNCEMENT of interest to many American radiologists is that of the Sagamore Chemical Co., Inc., of New York, that it is now able to supply the well known AGFA plates. That Company also has the x-ray films coated on both sides.

The AGFA plate was used quite generally in the United States prior to the war, and it has only been lately possible for the Sagamore Company, sole American agent, to obtain shipments in sufficient quantity to supply the market.



Commercial Exhibit, Annual Meeting

From the interest already manifested, it is safe to assume that the commercial exhibit at the annual meeting of the Radiological Society of North America, to be held in Detroit, December 4th to 8th inclusive, at Hotel Statler, will surpass anything of its kind in the history of the organization.

With all the available space sold and manufacturers and distributors of various appliances and apparatus clamoring that they be given room to show their wares, there is no question but that the capacity of the hotel will be taxed to the limit.

In this connection, it is probably only fair to say that the attendance bids fair to outnumber anything previously

of record in the science of radiology. A very comprehensive and instructive scientific program is being arranged, a scientific exhibit to which there has been nothing comparable in the history of the Radiological Society is assured, reduced railroad rates under the identification certificate plan will be in effect, and with the wide recognition that is being accorded radiant energy in its various forms both as a diagnostic aid and therapeutic agent, the meeting is sure to bring together an unusual number of men from all parts of the United States and Canada who are seriously interested in science.

The effort of the exhibitors will be to make their exhibits both interesting and educational. Each exhibit will be in the hands of competent men from whom information can be obtained without any embarrassment.

Exhibitors

Space No. 1—Patterson Screen Co., Towanda, Penn.

Space Nos. 2 and 3—Standard X-ray Co., 1932 N. Burling St., Chicago, Ill.

Space No. 4—Jno. V. Doehren Co., 208 N. Wabash Ave., Chicago, Ill.

Jno. V. Doehren Company will show a general line of roentgen accessories of the highest character. In particular the celebrated Gehler Folie Intensifying Screens, for which we are the general agency for the North American continent.

Space No. 5—Radium Chemical Co., Marshall Field Annex, Chicago, Ill.

The Radium Chemical Company of Pittsburgh will have on exhibit the latest apparatus used in connection with radium work, and will demonstrate several new methods for handling radium. The present tendency is toward simplicity, and with that end in view, new instruments have been designed to simplify the handling and application of radium.

Following out the custom of having a radium conference in Pittsburgh either before or after all national meetings, we desire to announce that for this meeting the conference will be held from December 11th to 15th, and all members of the Radiological Society are cordially invited to be present.

Space Nos. 6 and 7—James Picker, Inc., 497 Lexington Ave., New York City, N. Y.

Space No. 8—Sagamore Chemical Co., Inc., 213-15 Water St., New York, N. Y.

Sagamore Chemical Co., Inc., New York, American distributors for "AGFA" x-ray films and plates, will have an elaborate exhibit, which is now being prepared abroad.

Space Nos 9, 10 and 11—Engeln Electric Co., 4601-11 Euclid Ave., Cleveland, Ohio.

Space Nos. 12 and 13—Victor X-ray Corp., 236 S. Robey St., Chicago, Ill.

Chief among the apparatus which will be on display will be the new Victor Stabilized Mobile X-ray Unit, a recent Victor achievement, which is radically different from any type of x-ray apparatus heretofore offered to the profession. The three most outstanding features of this new unit are the Stabilizer, Auto-Transformer Control and Circuit Breaker. The merits of the Stabilizer are already apparent to the majority of x-ray users throughout the country. Not only does this device eliminate the disadvantages due to

line fluctuations, but it furthermore means a considerable saving in tube and film costs, not to mention the freedom from worry, and the certainty of results which will accrue to the user. The Auto Transformer control furnished with this new unit provides for twenty-six separate control steps, thus giving to the user a refinement of control that is truly ideal. The Circuit Breaker provided with this unit means not only protection to the tube, but also protection to the operator and patient.

Another Victor development which will be on exhibit is an improved type of stereoscope. This new outfit is the result of considerable experimental work by Victor engineers and combines features which make for a stereoscope of the utmost economy, simplicity of operation, beauty of design, and above all, even diffusion of light over the radiographs to be viewed, resulting naturally in more certainty in diagnosis.

The Victor line of Quartz Lamp Equipment will also be on display at the meeting. Both the Water Cooled and Air Cooled Lamps will undoubtedly attract the usual close attention on the part of the medical profession, but in addition there will be on display the new mobile hospital unit, which is designed so as to be conveniently wheeled from room to room.

Those in attendance at the meeting will also wish to carefully inspect the latest type of Victor High Frequency apparatus, a machine of portable construction delivering sufficient current for the treatment of any condition indicating the use of high frequency currents.

Space No. 14—Buck X-graph Co., 6629 Olive St., Rd., St. Louis, Mo.

This exhibit will consist of a display of X-Ograph Dental Film Packets, X-Ograph Developing and Fixing Chemicals, the X-Ograph Contact Cassette, and X-Ograph Universal Dental Film Mounts, including a dental film mount filing device and film viewer, incorporating a decided departure from the old method of mounting and viewing dental radiographs.

Space No. 15—George W. Brady & Co., 809-11 S. Western Ave., Chicago, Ill.

Space Nos. 16 and 17—Liebel Flarsheim Co., 410-16 Home St., Cincinnati, Ohio.

Space No. 18—Sweetbriar Laboratories, Inc., 1220-28 Hodgkiss St., N. S., Pittsburgh, Penn.

This exhibit promises something of unusual interest in the way of work done with the new Sweetbriar screens.

Space Nos. 19 and 20—Waite & Bartlett Mfg. Co., 53 Jackson Ave. Long Island City, N. Y.

OIL IMMERSED UNIT—This comes in a tank 23½ inches long, 12 inches wide, 13 inches high. Mounted in the tank is the high tension transformer and a separate filament current transformer. Above this is placed the lead glass shield and 30 milliamper radiator tube. The unit is shipped having the oil in a separate container. The tube goes in the regular crate. The tube holder, however, is arranged so that it is a very simple matter to put the tube in the lead glass shield and mount it in the tube holder, which is permanently attached to the under part of the cover.

There can be an opening in the top of the box for the x-rays to come through, or it can be placed on the side. It can also be arranged so as to take the same shutter that is used with our fluoroscope.

This unit can be mounted on a carriage under a fluoroscopic table, or it can be mounted between two uprights having a counter-balance adjustable by height.

NEW MODEL RADIOGRAPHIC AND FLUOROSCOPIC TRANSFORMER WITH OIL IMMERSED AUTOMATIC THROW HIGH TENSION SWITCH—This transformer is in a tank 16 inches long, 12 inches wide, 14 inches high. In this tank is mounted a high tension transformer, filament current transformer and double throw automatic high tension switch. There is a double set of high tension terminals coming out of the top. When this is connected with the control cabinet or control panel, the high tension switch is automatically thrown one way or the other, according to whichever foot switch the operator steps on. This does away with having to stop to turn the high tension switch or to even give it any thought. A still greater advantage is that it does away with the oxidation which takes place in the filament circuit of the ordinary exposed high tension switch, causing trouble.

NEW MODEL CONTROL CABINET FOR THIRTY MILLIAMPERE TRANSFORMER—The same equipment, instead of being in cabinet form, the cabinet mounted on a slate base so that it can be readily placed against the wall.

This control cabinet can be used either with the fluoroscopic transformer or with the oil immersed unit. The switch-board or cabinet, contains the following:

Coolidge meter, voltmeter and milliammeter.

Auto-transformer adjustable in two-volt steps.

Adjustable overload circuit breaker with double silver contacts opening both sides of the line.

Automatic current regulator which will keep the milliamperes constant at five or thirty. This is controlled by means of a two-way switch which is marked "Fluoroscopic and X-ray."

Two connections for floor switches to be used either singly or in combination with the fluoroscopic transformer, having an automatic high tension oil switch.

A plug connection for floor foot switch. This is arranged so that it is impossible to use 30 milliamperes except when the switch is on the side which enables you to use the foot time switch. In other words, you cannot possibly turn on 30 milliamperes with the ordinary foot switch.

There is another outlet which can be connected with a red light overhead so that when the foot switch is used the red light automatically goes out.

NEW MODEL G-U MASSACHUSETTS FLUOROSCOPIC AND BUCKY DIAPHRAGM TABLE—This consists of a table having the Bucky Diaphragm permanently attached to it and movable. At one end underneath is placed an oil immersed fluoroscopic unit which is adjustable six inches each way. Attached to the base of the Bucky is an upright which supports the oil immersed unit, arranged so that the rays come out of the bottom of the tank. This is

accurately centered over the center of the Bucky so that after the operator has made a fluoroscopic examination, he can, without moving the patient, simply push the Bucky down to the other end of the table under the patient; the Bucky having been previously loaded with the film. The control board can be mounted at one end of the table if desired, so as to eliminate all wiring possible.

NEW AND ORIGINAL MODEL STEREOSCOPE—This is mounted on a counterbalanced stand so that the operator can sit down in a comfortable chair in front of it and make his examination without any discomfort.

The illuminating boxes are novel in construction, the curtains being placed inside of them but being adjustable from the outside. This enables the placing of a cross-bar so that the films can be readily held in position without any difficulty.

This apparatus stereoscopes very much easier than the ordinary type owing to the fact that the operator looks directly at one plate with one eye; while the other eye looks at the mirrored surface. It is hard to believe what a very great difference in clearness this arrangement results in.

UNITED STATES ARMY MOBILE UNIT—This is the model such as was made up for the U. S. Army in conjunction with the late Professor John S. Shearer of Cornell University, and represents the result of his experience in France. It has been designed with a view to economy of space without losing the advantages of universal adjustments.

This is in a cabinet 20 inches wide, 24 inches deep, 36 inches high. There is a 35 foot service reel permanently attached in the cabinet to be connected with the electric light service. There is space so that a rotary converter can be used to operate up to ten milliamperes, and mounted in this unit. The sides are all removable, so that every part is accessible.

This is a unit which every hospital should have. It will do all kinds of radiographic and fluoroscopic work. It is, of course, not suited for therapy or for instantaneous work; but it will answer the requirements of any small hospital.

LATEST IMPROVEMENT ON 10 K. W. INTERRUPTERLESS MACHINE FOR ALTERNATING CURRENT—This 10 K. W. Interrupterless Machine has been improved in the following ways:

All makes of alternating current interrupterless machines have polarity indicators; so that when the apparatus is put into operation the operator is supposed to look at the polarity indicator and then turn the pole changer switch one way or the other. If, however, he fails to do this and closes the operating switch, the polarity may be wrong and the possibilities of puncturing a tube are very great.

With this new arrangement, this is all absolutely avoided. It is simply impossible to turn on any high tension unless the polarity is correct. When the machine is started up there is a red light. If this lamp lights up the polarity is wrong. If, however, the operator neglects to pay any attention to it and goes ahead and closes the operating switch, nothing will happen, he simply cannot get any high tension. He will then, of course, look to see what is the matter and notice the red light, which means that the pole changer should be turned in the opposite direction. This device is exceedingly simple and there is nothing whatever to get out of order.

This unit also carries an auxiliary contact. This is for use in making automatic stereoscopic exposures in combination with the new electric-trip stereoscopic tubestand and electric-trip vertical plate changer. In order to do stereoscopic work with the new equipment, it is simply necessary to load the plate changer, place the patient in position, and

have the tube in position for the first exposure. The operator then simply closes the operating switch. This will make the first exposure, and the instant it is over the tube will shift and the plate changer will revolve. During this period the time switch will reset itself; and the instant the second plate comes into position the second exposure will be made and cut off.

Space No. 21—French Screen Co., 406 McKerchey Bldg., Detroit, Mich.

Space Nos. 22, 23 and 24—Kelley-Koett Mfg. Co., Inc., Covington, Ky.

Space Nos. 25 and 26—Radium Co. of Colo., Radium Bldg., Denver, Colo.

The Radium Company of Colorado will exhibit a complete line of radium applicators and accessories. In addition to the usual instruments which have been regularly furnished with radium, the equipment shown will include numerous accessories of new designs.

The gold needle with platinum-iridium tip has been discontinued and needles of platinum-iridium or non-corrosive steel, are recommended. Possibly the most interesting development in needle design will be the new short length non-corrosive steel needles containing five milligrams each. These needle applicators, which are exactly one-half the length of the ten milligram needles and identical in external diameter, will be shown with accessories to facilitate application. The advantage in using the short needles of this design in conjunction with the standard long ten milligram needles will be demonstrated, with reference to the adaptability of standard screens.

A slender needle designed to contain three or five milligrams of radium element will also be included. Platinum-iridium needles of sufficient wall thickness to absorb all beta radiation will illustrate the prevailing tendency in French design of such radium applicators. Brass capsule screens to contain needles have recently been added to the equipment not shown in the company's catalog.

Among new accessories for needles is a new type of needle introducer which has practically eliminated every difficulty in threading. The instrument is designed for imbedding non-corrosive steel needles. It will be shown in six, eight, ten and twelve inch lengths.

Another needle accessory is the flexible needle-holder, designed for use in conjunction with some standard form of operating cystoscope. This special needle introducer is supplied to meet a demand for a simple attachment for any standard instrument to avoid the necessity of duplicating the expensive lens system and other parts of the entire cystoscope. As an operating cystoscope is invariably found in the urologist's armamentarium, the new accessory will probably meet with general approval.

The result of considerable study and co-ordination of ideas obtained from numerous radium therapists will be seen in a new form of esophageal applicator. The chief advantage claimed is the simplicity of design. The instrument will be shown in various sizes to contain either glass radium-containing tubes or metal needles.

A new form of metal lined carrying case for radium needles will be shown. This case has been designed to accommodate the wires attached to needles, thereby providing a satisfactory container to hold the needles when ready for application. The number of needle compartments is made to meet individual requirements.

Metal-covered plaques in the design of which a marked departure from existing practice has been made, will be shown with records to illustrate the advantage of the new instrument over the older form of composition-covered

plaques. The radium in the new flat applicator is distributed directly beneath a very thin layer of Monel metal, which permits the passage of approximately three times as much beta radiation as escaped through the much thicker layer of composition. These plaques are shipped in new lead-lined carrying cases which will also be included in the equipment shown at the Radium Company of Colorado booths.

Adaptable applicators have been designed to facilitate the application of glass tubes or metal needles in the treatment of skin conditions. Several types of these instruments will be shown, including applicators to hold two glass tubes in separate compartments, and instruments to contain five or more needles. In each instrument the primary applicator is held in position beneath a very thin layer of non-corrosive steel.

Several forms of very practical distance applicators will be shown, including a special form of eye cup to hold radium tubes or needles at a distance of approximately twenty-five millimeters. The distance applicators and eye cup are supplied with special sheet-metal screens of various thicknesses. A convenient screen of gold-plated brass, moulded to fit the contour of the eye may also be mentioned.

Among the general accessories will be included, Balsa wood for blocking radium away from the skin. It is an extremely light weight wood, highly recommended on account of the ease with which it may be cut to the required shape and also because it absorbs very little gamma radiation. A special grade of Kerr's Dental Compound, Bronze Ligature Wire for radium needles, sheet-lead in various thicknesses and special forms of pure rubber tubing will also be exhibited.

The above mentioned articles are some of the new accessories which, together with the other instruments that the company has regularly furnished its clients, will be demonstrated by representatives, who will be in attendance at booths twenty-five and twenty-six during the entire session.

Space Nos. 27, 28 and 29—Acme X-ray Co., 341-51 W. Chicago Ave., Chicago, Ill.

Space Nos. 30, 31, 32 and 33—Wappler Electric Co., 162-84 Harris Ave., Long Island City, N. Y.

WAPPLER COMPOSITE X-RAY UNIT—Among the new developments that the Wappler Electric Co. will have on display will be the Wappler Composite X-ray Unit. This apparatus has been on the market for about six months and in that time has been proved a phenomenal success. It is truly composite, being made up of all standard Wappler parts, "Integral Units." The initial Integral Unit or part can be obtained at once at a small expenditure and by means of further moderate investments, at any time, a purchaser can complete his Composite Unit.

A careful inspection of this apparatus is suggested.

WAPPLER DUPLEX MODEL ROENTGEN RAY MACHINE—A second interesting development will be the Wappler Duplex Model Roentgen Ray Machine. This apparatus is truly Duplex. It has a capacity of Radiography of from 1 to 70 milliamperes at a 6-inch back-up and a Therapy capacity of 1 to 8 milliamperes at a 15-inch back-up. It is most reasonably priced, attractively finished, and fully efficient in every way.

WAPPLER VERTICAL FLUOROSCOPE—Incorporated also in this exhibit will be the new Wappler Vertical Fluoroscope, affording a radical departure in the method of mounting the tube. The Trochoscope or Tube Box of this Fluoroscope is of an entirely new design, entirely made of metal and affords a maximum protection. An additional feature incorporated in this new type Fluoroscope is an adjustable seat, by means of which children can be comfortably

examined with the operator in a standing position, or patients in a weakened condition can be seated for examination.

COMPLETE WAPPLER DEEP X-RAY THERAPY EQUIPMENT—As an accessory exhibit to the main Wappler exhibit in the Statler Hotel, a complete Wappler Deep Therapy installation, including a Wappler Deep Therapy

Transformer and Rectifier, Wappler Safety Tube Holder and Table, Sphere Gaps, etc., etc., will be installed and running in the Shurly Hospital, a short distance away from the hotel. Actual clinics will be held using this installation during every day of the meeting and interested visitors will be welcomed.

Commercial Exhibit Room B

Space No. 13—Horlick's Malted Milk Co., Racine, Wis.

Space No. 14—National X-ray Screen Company, 24 North Wabash Avenue, Chicago, Ill.

Space No. 15—Roentgen Appliance Company, 667 Howard St., San Francisco, Calif.

Space No. 16—T-E X-ray Laboratory, So. Bethlehem, Pennsylvania.

This exhibit will consist of T-E Screens, Cassettes and Units shown in such a manner as to clearly point out the many advantages and fine points of these products.

Space Nos. 17 and 18—High Tension Transformer & Equipment Corporation, 200 Washington St., Hoboken, N. J.

The "Intermediate" X-ray Unit has achieved unusual success in embodying a machine of large capacity in exceptionally small space. Intense interest has been shown in this unit on account of its distinctive type of rectifying mechanism—the Rotary Wave Selector—which has made it possible to build in a mobile form a machine for x-ray therapy up to 5 ma. at a 9-inch gap and for radiography up to 40 ma. at a 6-inch gap.

The "Special" Combination X-ray and High Frequency Machine will also be demonstrated. This machine is equipped to operate the radiator type tube up to 30 ma. at a 5-inch gap and also to give both Oudin and D'Arsonval currents when treatment with these is indicated.

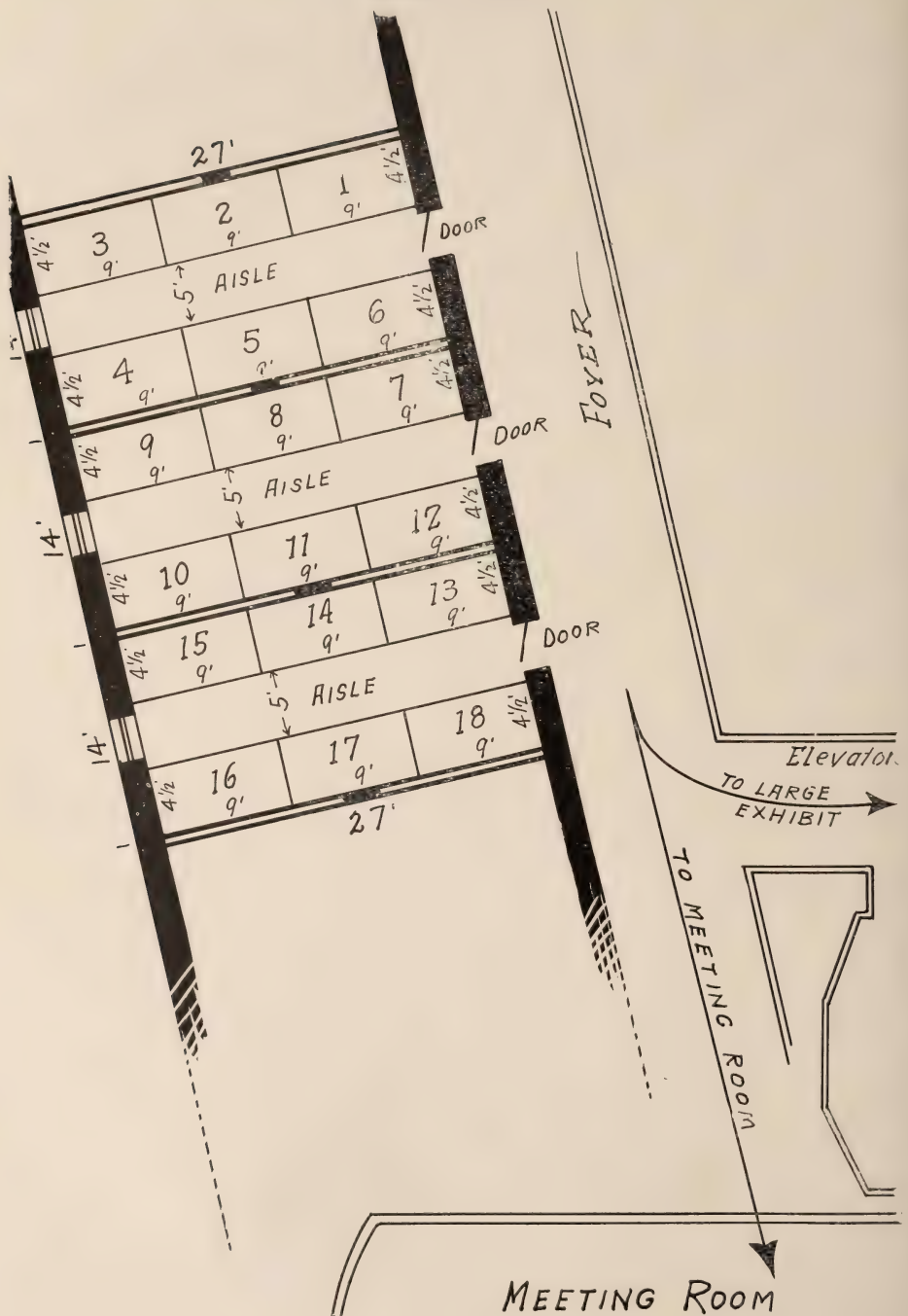
The efficient Multiple Spark Gap is an exclusive feature of "High Tension" high frequency machines and has become recognized as the most ideal high frequency gap yet developed.

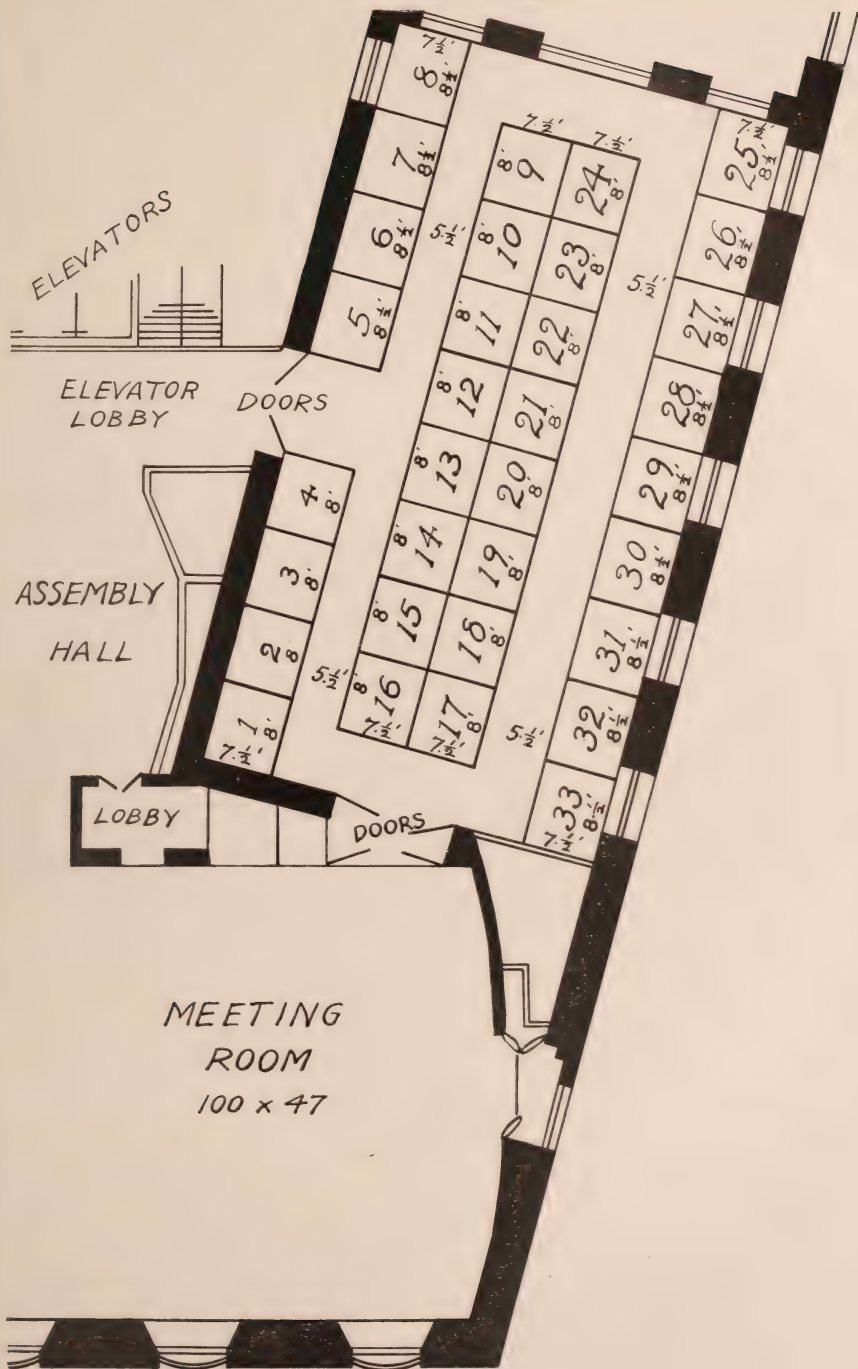
The "Special" machine is also equipped with hot cautery, rapid sinusoidal and taps for operating electrically lighted diagnostic instruments.

The "Standard Jr." High Frequency Machine is designed to generate exclusively Oudin and D'Arsonval currents of delicate regulation and a wide range of intensities from the mildest effluve to those of deep thermic effect as used in electro-coagulation of dense growths. This is the apparatus which has been widely named "The real high frequency machine."

Every physician is cordially invited to visit booths 17 and 18 and inspect these machines.







ABSTRACTS *and* REVIEWS

Modern Views of Cancer. Harry C. Saltzstein. M. D., J. Michigan M. Soc., 21:429, October, 1922.

IT IS TRUE that some tumors develop from misplaced embryonal cells, but the vast majority develop apparently irrespective of misplacements and their presence does not always indicate that neoplastic growth will follow, neither does their growth always result in tumor.

Ribbert's doctrine of cell autonomy holds that cells removed from active growth restraints will at once start on a riotous, autonomous new growth. Mechanical pressure, specificity of function, nutrition and organization are some of the forces of tissue tension the disturbance of which may result in such unrestrained growth.

Breaking down of encapsulation, with resultant release of mechanical pressure, often is followed by malignancy. Specialized function, such as secretion of the gastric juice, of milk or of mucus, inhibits growth capacity, but when in the breast or uterus, for example, the specialized function ceases it often becomes a case of "Satan finds some mischief still" for idle cells to do, and neoplastic growth results.

Of nutrition the author says: "Tumor cells have an abnormal capacity to absorb nutriment. In certain instances a hormone has been supposed, or that they exerted some influence on neighboring cells. Why they can assimilate so voraciously is, however, a very obscure problem."

As to organization he says: "Cancer has lost the control of the organism." Regeneration of a limb in a crustacean is an illustration of growth under control of an organism. Frequently cell groups become displaced through some pathological process. Many cancers follow chronic inflammatory irritation, which leads to the theory that successive generations of cells subjected to ceaseless trauma finally may lose the body growth restraint.

The parasite theory of tumor growth "is as old as the history of medicine itself." Much experimental work has been done along the line of this theory, but there are many complex factors involved which make the value of the statistics secured by this study very difficult to interpret. Bacilli, cocci, spirillae, mycelia, blastomyces, yeasts, ameba—all have been cultivated from cancers and tumors have in some instances been reproduced, but the most

of them have been granulomas. Infection, the author remarks, produces degeneration and wasting, but the transplanted cells of cancer grow where they lodge and the parasite, if such there is in this disease, would have to live in symbiosis with the cell. It is true that Nuzum seems to have fulfilled this condition in his experiments with the Crocker mouse carcinoma, but the parasite isolated by him in this study grows only very slowly unless aided by tumor trauma.

The answer to the enigma may be wrapped up in the mysteries of biochemistry, but for the present our sole practical knowledge is that cancer begins locally and only when it is removed early is it curable.

Cancer and Parasite. Isidor Kross, *Columbia University, Institute of Cancer Research*; J. Cancer Research, 6:257, October, 1921.

NUZUM recently tried to demonstrate a bacterial cause for mouse carcinoma No. 11 of the Crocker Institute and believed that he had done so. He isolated a diplococcus from this particular carcinoma and inoculated a culture of it into mice who then developed this same type of tumor.

The author has carried on further experiments with this carcinoma No. 11 and believes that he has disproved the validity of Nuzum's conclusions.

The tumor cell and the micro-organism are the two factors upon which the author based his experimentation. To prevent the tumor cells from participation in the production of growths induced by inoculations of tumor No. 11 he administered sufficient x-ray dosage to several mice to kill the tumor cells. Twenty-four mice were then inoculated with the aseptically excised tumor and cultures were also made, according to Nuzum's technique, from the excised tumor and inoculated into 60 mice.

The second method of destroying the tumor cells before inoculation was alternate freezing and thawing. Controls were used throughout all experiments.

The author's conclusions are as follows:

"1. While most of the ascitic tissue fluid cultures of Crocker Institute carcinoma No. 11 contained micro-organisms of various kinds, in no instance was there found the characteristic micro-organism described by Nuzum.

"2. In not a single instance was the

inoculation of the mice with these cultures followed by tumor growth.

"3. It is probable that the two undoubted tumors in Nuzum's series were a spontaneous new growth."

The Influence of Hydrogen Ions and of Various Salts in Different Concentrations Upon the Growth of Transplanted Flexner-Jobling Rat Carcinoma. Kanematsu Sugiura, Helen Miller Noyes and K. George Faulk, *From the Huntington Fund for Cancer Research, Memorial Hospital, and the Harriman Research Laboratory, The Roosevelt Hospital*; J. Cancer Research, 6:285, October, 1921.

ALBI NO RATS were inoculated with the Flexner-Jobling rat carcinoma after the grafts had been immersed in solutions of various salts of different hydrogen ion concentration. The tumors were allowed to grow for from six to seven weeks. It was found that calcium strongly inhibited growth and a pH of 6.0 was found to be more harmful than one of 8.0.

The growth of tumors was compared with the protease action of extracts of malignant human and rat tumors. The optimum hydrogen ion concentration for protease action and the favorable medium in which tumor fragments on immersion retain their ability to grow when transplanted corresponds very closely to that represented by a pH of 7.0, unfavorable conditions for both being reached more rapidly on the acid side than on the alkaline side.

The authors conclude that the connection between the conditions affecting the permeability of cell membranes, the factors which influence the activities of intracellular enzymes, and the relations of the inorganic constituents of neoplastic or other tissue, is still obscure and requires much more experimental study to make it clear.

Primary Spontaneous Tumors in the Kidney and Adrenal of Mice: Studies on the Incidence and Inheritability of Spontaneous Tumors in Mice, 17th Communication. Maud Slye, Harriet F. Holmes and H. Gideon Wells, *Otho S. A. Sprague Memorial Institute and the Dept. of Pathology, University of Chicago*; J. Cancer Research, 6:305, October, 1921.

THIS PAPER covers 30 pages, to which there is appended the

authors' summary and a bibliography of 52 references. The following is from the authors' summary:

"In a series of 33,000 autopsies on mice of the Slye stock, dying natural deaths at all ages * * * there have been observed * * * cases of true primary neoplasm arising from renal or adrenal tissues." These numbered 25 and are classified as follows:

Kidney—1 carcinoma, 3 adenomas, 1 hypernephroma, 8 sarcomas, 3 mesotheliomas.

Adrenal—1 cortical adenoma from a misplaced inter-renal adrenal rest, 3 mesothelial tumors.

Five others of mesothelial structure characteristic of urogenital anlage neoplasms, but their exact origin could not be determined.

Five thousand other tumors were presented in these 33,000 mice, so these 25 are taken to be uncommon tumors in mice, at least in mice of this particular stock.

There was found no instance of a mixed renal tumor of the Wilms type and there was not a single case of typical malignant hypernephroma. Although inflammatory conditions are very prevalent in mouse kidneys epithelial tumors are rarely found; none of these were found in the renal pelvis though one of the sarcomas seemed to take its origin in the pelvis.

Several instances of malignant retroperitoneal tumors have been observed, but only two were included in this series.

"Secondary tumors have never been found in the adrenals, and but rarely in the kidneys. Although this series includes at least 3,000 cases of mammary carcinoma, often with widespread metastases into the lungs, we have never seen a secondary carcinomatous growth in the kidney. The only secondary carcinomas of the kidney as yet observed are four cases in which the primary carcinoma was in the lung, thus establishing the true neoplastic nature of these lung growths. In but two cases have metastatic sarcomas been seen in the kidney, if we exclude the numerous cases of invasion of the kidney by direct extension from para-renal growths."

Little difference in the incidence in the sexes was noted. Except for one case there was no incidence of malignancy in mice under four months old and but few under six months old. Most of the renal sarcomas occurred between the ages of seven months and one year, somewhat earlier than the usual time of appearance of epithelial growths and corresponding to experience with human neoplasms.

"The epithelial renal and adrenal tumors furnished no illustration of metastasis, but in three cases of sar-

comatous or mesotheliomatous growths there was noted involvement of the adjacent lymph nodes; in two there were pulmonary, in two hepatic, and in one splenic metastasis, and in one case there were numerous peritoneal growths. The mesothelial type of growths produced the most extensive metastasis and the most widespread infiltration of the body wall."

A review of the literature disclosed only six other cases of renal tumors in mice, all epithelial, and showed no adrenal tumors.

A Critical Investigation of the Freund-Kaminer Reaction. Louis Herly, *Columbia University, Institute of Cancer Research*; J. Cancer Research, 6:337, October, 1921.

FREUD and Kaminer in 1910 reported certain phenomena which occurred when tumor cells were mixed with blood serum from non-cancerous individuals on the one hand or with blood serum from cancerous patients on the other hand. The relationship thus discovered is known as the Freund-Kaminer reaction.

Their studies showed that the serum from non-cancerous subjects destroyed most of the cancer cells. Non-cancerous serum did not destroy normal cells whether these were from normal persons or from those having cancer. They argued from these studies that resistance of carcinoma cells to carcinoma serum pointed to some lytic property in normal serum rather than to any vulnerability of the carcinoma cell. Recently they have published further experiments to show that the normal serum and tissues contain an organic fatty acid able to destroy cancer cells. They call this "normal acid." They believe that cancer and the serum of cancer patients contains an acid that protects the cancer cell by destroying the normal acid.

The authors of this paper believe that in the studies of Freund and Kaminer it is open to question what proportion of the cancer cells used were alive and whether the serum used might not have been more or less decomposed since sometimes the serum was obtained fresh and sometimes postmortem.

They summarize the conclusions from their own study thus: "The conclusions to be drawn from the whole series of experiments are equally clear. After having made sure that there was no difference in the action of either rabbit or guinea pig serum on the one hand, and rat serum on the other; and after having eliminated the sources of error enumerated by Freund and Kaminer, namely, the admixture of connective tissue capsule and its blood vessels the presence of red blood cells in

the serum, the use of old serum or of serum obtained at the height of digestion; and having, furthermore, used carcinoma (the most sensitive tumor to this test, according to the originators) instead of sarcoma, as had been done by previous investigators, we are still unable to detect any marked difference in the results of inoculation, whether tumor serum or normal serum is used. The growth capacity seems neither increased in the one nor diminished in the other. We feel justified in stating, therefore, that the Freund-Kaminer reaction remains at present unproved. With this proviso, however, that these experiments prove only that the serum of normal rats is devoid of any deleterious effect on the Flexner-Jobling rat carcinoma. What might be the case with serum from a rat bearing a spontaneous carcinoma we do not know. However, the first half of the experiment seems sufficient; for since this shows clearly that normal serum has no harmful effect upon the cancer cell, there can be no difference with respect to cytolytic power between normal serum and that of an animal with a tumor, be this transplanted or spontaneous."

The Relation of Muscular Activity to Carcinoma: A Preliminary Report. Ivar Sivertsen, M. D., and A. W. Dahlstrom, M. D., J. Cancer Research, 6:365, October, 1921.

THE FREQUENCY of carcinoma observed in retired farmers and the improvement of precancerous patients on a prescription of increased daily exercise led the authors of this paper to consider what relation muscular activity might have to carcinoma.

According to Hoffman's statistics carcinoma is more prevalent among the unoccupied and the leisured and professional classes than in the opposite classes, and also it occurs more frequently in over-nourished or well fed and well housed individuals than in the poor. It is also more prevalent in warmer climates. Reading between the lines of these statistics the authors find support for their theory that muscular activity in some way protects against cancer.

Among domesticated animals, and fish artificially bred, carcinoma is more frequent than in wild life, although it is admitted that there probably has not been the same study made of wild life owing to lack of opportunity.

"The present day labor saving machinery, convenient means of transportation, and ultraconveniences of modern life all tend to make us less active physically, and it appears to us that the increasing curve of carcinoma closely approximates the inauguration

of the Age of Machinery."

The authors advance the working hypothesis: "That human carcinoma may be the reaction to and the result of chronic irritation of adult epithelial tissue bathed in body fluids altered by certain metabolic products as a result of deficient muscular activity. From a study of the carcinoma deaths among males in Minnesota for three years it appears that the death rate in those who are active is greatly exceeded by the death rate in those who are inactive. From a study of the death rates of those who are actively engaged in a gainful occupation it appears that the death rate is lowest in those occupations involving the greatest amounts of necessary muscular activity, and is highest in those occupations involving the least muscular activity. The age incidence factor of the cases studied does not explain the variations shown."

Central Bone Tumors and Their Differential Diagnosis: With Special Reference to the Latent and Unhealed Bone Cysts in Adults. Joseph Colt Bloodgood, M. D., Minnesota Med., 5:604, October, 1922.

THE AUTHOR reported in the Journal of Radiology, for March, 1920, fifty-four cases of bone cysts, in six of which the onset occurred after the age of twenty. He reviews these six cases, and propounds the question, "What shall be our procedure of attack when an adult comes under observation with an x-ray picture showing the central lesion with an intact bony shell, with or without evidence of a recent fracture?"

The possible central lesions are benign giant cell tumor, central sarcoma, bone cysts, chondroma and myxoma, tuberculosis, chronic osteomyelitis, multiple myeloma, metastatic tumors, and multiple primary central sarcoma.

"When is exploration justifiable in central bone lesions with intact shell, with or without recent fracture?" This refers to central lesions in patients over fifteen years of age. The unhealed bone cyst should be curetted. The central giant cell tumor does not require radiotherapy; it will not recur if curetted properly with chemical or thermal cauterization. If a chondroma or myxoma is revealed by operation, curetting with cauterization offers more hope than radiotherapy. If the rare central sarcoma is revealed by the operation, it would seem justifiable to curette with the cautery, with chemical disinfection, followed by radium in the bone cavity. If one explores a central tumor with an intact bony shell and is unable positively to rule out sarcoma, the treatment should be most thorough destruction with the cautery, then

sawbarring the bone cavity with pure carbolic acid and alcohol and 50 per cent chloride of zinc, following this by the introduction of radium, and this should be followed up by postoperative x-ray and radium treatment.

W. W. W.

Unusual Cases Showing the Diagnostic Value of the X-ray. Lester J. Williams, M. D., New Orleans M. & S. J., 75:177, October, 1922.

FRacture of the tibial spine, osteochondroma, Schlatter's disease and Perthes' disease are the types of cases selected by this author to illustrate the value of x-ray methods of diagnosis.

The fracture of the tibial spine made a complete recovery with normal function restored. The case of Schlatter's disease had followed an injury, but there was quite a decided suggestion of some endocrinal factor as a predisposing cause. The Perthes' case gave no history of injury or antecedent infection; the deformity was quite marked, owing to its comparatively long standing when examined.

W. W. W.

Experimental Rickets in Rats: VII.

The Prevention of Rickets by Sunlight, by the Rays of the Mercury Vapor Lamp, and by the Carbon Arc Lamp. Alfred F. Hess, M. D., Lester J. Unger, M. D., and Alvin M. Pappenheimer, M. D., J. Exper. Med., 36:427, October, 1922.

"YOUNG RATS on a diet low in phosphorus can be protected from rickets by irradiations with sunlight for about fifteen minutes daily. In the winter months this degree of light was found insufficient. The effective rays of the sun, in the intensities studied, did not penetrate window glass. They manifested some protective value after reflection from a smooth white surface.

"Irradiation of a few minutes with the rays of the mercury vapor lamp suffices to protect rats against rickets. This is true likewise of the rays from a carbon arc lamp. A standard protective dose of radiation can be formulated for rats on a standard diet.

"Light is able to prevent the occurrence of rickets in rats fed a rickets-producing diet characterized either by a low phosphorus and high calcium content, or a high phosphorus and low calcium content.

"Moderate variations in temperature do not alter the effective action of light rays. Pigmentation of the skin markedly lessens their effect, as demonstrated by the failure of a standard dose to protect black rats."

Experimental Rickets in Rats: VIII.

The Effect of Roentgen Rays. Alfred F. Hess, M. D., Lester J. Unger, M. D., and Joseph M. Steiner, M. D., J. Exper. Med. 36:447, October, 1922.

THE PROTECTIVE value of soft roentgen rays on rachitic rats was tested out and it was found that "rats on a low phosphorus diet cannot be protected from the development of rickets by exposures to soft roentgen rays such as were employed in this study."

In addition to the preventive test a series of rats were subjected to massive doses of roentgen rays to see if the resultant cell damage might lead to rickets, but these rats "on a diet containing phosphate in an amount adequate to prevent rickets were not rendered rachitic by exposure to massive doses of roentgen rays of an intensity sufficient to produce marked destruction of the blood forming cells of the marrow."

Absence of the Radius with Double Ulnae. Carl Mau, M. D., Ztschr. f. orthop. Chir., 42:355, June, 1922.

SIMILAR cases first described by Kummell, Carre and others who reported cases of double radii with double thumbs and absence of the ulna are reviewed before the author describes his own case, which was that of a boy nine years of age when the case came under the author's observation. The radius was absent in the left member, two ulnae were present, the thumb was absent and there had been eight fingers previous to surgical removal of some of these.

Examination revealed some atrophy of the muscles of the shoulder and arm of the left side; the left elbow was somewhat wider than normal, the olecranon process could not be felt, but one could feel two lateral prominences and one central projection. Some functional changes were recognized, which, however, did not very markedly interfere with the patient's routine.

The roentgenogram was very interesting. It showed both bones of the forearm to be ulnae, the medial and the lateral sides of the forearm were symmetrical in every particular. The two olecranon processes occupied the median and lateral lower ends of the humerus. No olecranon fossa was observed. Eleven of the carpal bones were seen and the navicular bone was absent, as would be expected in the absence of the radius. At that age the pisiform bone had not yet appeared. There seemed to be two sets of the remaining six bones, but one was missing due to the surgical interference men-

tioned above. Of the digits and their metacarpals, no thumb metacarpal was observed as all had proximal epiphyses, while the thumb had a distal epiphysis. A. M. P.

The Roentgenological Aspects of Achylia Gastrica. A. W. Crane, M. D., *Am. J. Roentgenol.*, 9:527, September, 1922.

ACHYLIA gastrica is used by this author in the sense of "An established chronic disease of the stomach characterized by the persistent absence of free hydrochloric acid in the stomach contents during the whole of the digestive cycle."

The importance of achylia gastrica to the roentgenologist lies in its frequency of occurrence in gastro-intestinal cases, its association with abdominal pain and intestinal disturbances, and in "the differences in the interpretation of the same roentgen ray signs, according to whether or not achylia is present."

A single sample of the stomach contents is never sufficient evidence to establish a diagnosis of achylia gastrica. In the one thousand cases forming the basis for the conclusions drawn in this paper the stomach contents were obtained in five to six fractions taken at intervals of fifteen minutes.

Achylia was found in 158 of these cases, 12.6 per cent, and in not one of the 158 was ulcer ever found. Of 393 cases showing a hyperacidity, 117 showed duodenal ulcer and 25 showed gastric ulcer. Pain was present in 102 of the 158 cases of achylia gastrica though study of the causes leads to the conclusion that achylia itself is not often accountable for pain. If gastric cancer or syphilis can be excluded then the cause of the pain probably is not in the stomach.

The literature is cited to support the view that diarrhea is often present in cases of achylia. Twelve of the 158 cases in this study complained of this ailment. This condition may sometimes explain rapid expulsion of barium meal with intestinal hypermotility.

Carcinoma of the stomach cannot be distinguished from syphilis of the stomach by clinical, laboratory or x-ray methods, nor even by an exploratory laparotomy. Tuberculosis and circulatory diseases and dental infection should be eliminated from the diagnosis before a diagnosis of achylia is rendered. Pernicious anemia and gastric cancer may present very much the same clinical picture, but proper interpretation of roentgen findings will usually clearly differentiate the lesion. Duodenal ulcer and achylia may cause the same stomach symptoms and make differentiation very difficult.

Further Studies of the Internal Organs of the Newborn. E. Vogt, M. D., *Fortschr. a. d. Geb. d. Roentgenstrahlen*, 29:405, April, 1922. (See *J. Radiol.*, 3:150, April, 1922, for abstract of previous study.)

HILUM shadows are entirely absent in the normal newborn child, because of the softness of the bronchi, absence of glands, and the small size of the vessels.

The author has observed a number of cases of thickened lung markings in newborn and prematurely born infants. This thickening could not possibly have resulted from respiratory conditions and the author came to the conclusion that the lung markings represent the vascular system in the lungs. This conclusion was further substantiated by the fact that an injected lung vascular system showed injected vessels corresponding to the normal lung markings of the same patient. Thickening of these lung markings was also found in conditions of heart disease with congestion of the small circulation.

The author's roentgen medico-legal test to determine whether there has been postpartum life depends upon whether air is found present upon roentgen examination of the gastro-intestinal or respiratory tract. This test has failed, however, in at least one instance when no air was found present in a prematurely born child known to have lived ten hours after birth. The author explains this phenomenon by the fact that the immature, weak infant needs very little air; that the absence of a sufficient quantity of carbon dioxide gives rise to no need of air, and that the musculature was too weak to bring about appreciable expansion of the chest. The same thing is true in malformations and the author reports a case of obliteration of the esophagus where the chest was well expanded, but there was not a trace of air in the gastro-intestinal tract.

In gastro-intestinal observations the author found that in a child ten days old the splenic flexure is much above the hepatic flexure, the ascending colon is rather short, the descending colon is usually slightly to the right of the midline, and the sigmoid flexure is at about the crest of the ilium. The sigmoid and the colon in general were found to be very mobile, a condition which is often the cause of Hirschsprung's disease.

The adrenal gland consists chiefly of capillaries, according to this author. This was determined from the fact that an injection of the vessels resulted in an enlargement three and one-half times the normal size. The hair-like capillaries could be easily demonstrated on the plate. This explains the frequency

of hematomata in the newborn, often a cause of death.

The capacity of the urinary bladder of the newborn was found to be about 40 cc. Its shape when filled is oval, when not filled it is pear-shaped. When filled the bladder reaches out of the pelvis to about the level of the navel. The peritoneal covering is limited to the top of the bladder, while the anterior wall is free from the peritoneum. A. M. P.

The Duration of the Passage of Ingesta Through the Gastro-Intestinal Tract of Infants. Walter Kahn, M. D., *Ztschr. f. Kinderh.*, 29:321, July, 1921.

THE AUTHOR notes that there is a general lack of definite data on this point. He himself has made a number of observations using in the otherwise normal meal small admixtures of substances such as wood charcoal, animal charcoal, carmine, and licopodium powder, which could easily be recognized both macroscopically and microscopically in the excreta. The x-ray was used to determine the length of time the meal remained in each of the individual parts of the gastro-intestinal canal.

The following are the data from the above study: (1) The duration of the passage of the ingesta through the gastrointestinal canal in infants is rather short, ranging between four and twenty hours, and being about fifteen hours in the majority of cases. (2) In the early morning hours duration is generally shorter than at any other time of the day. (3) The duration is shorter with breast fed infants than with bottle fed ones. (4) The emptying time of the stomach is at most four to five hours. The small intestine is empty after seven to eight hours. Passage through the large intestine ranges from two to fourteen hours.

A. M. P.

A New Sign to Distinguish Between Carcinomatous and Non-carcinomatous Stenosis of the Esophagus. Eugen Weber, M. D., *Fortschr. a. d. Geb. d. Roentgenstrahlen*, 29:362, March, 1920.

IN 75 cases of definitely proven carcinomatous stenosis and in 16 cases of definitely proven non-carcinomatous origin the author's sign was found correct. The patient is given about 30 cc. of an opaque meal under fluoroscopic observation. In a few minutes, when the meal is still seen in the esophagus above the stenosed area, the patient is asked to state whether it has passed through or not. In carcinomatous stenosis the reply is positive, while in non-carcinomatous stenosis the patient

feels that the meal is still in the esophagus.

The author attributes this loss of sensitiveness in the esophagus to a gradual infiltration by carcinomatous tissue of the area of carcinomatous growth. In non-carcinomatous stenosis the mucosa is unchanged and so retains its sensitiveness.

A. M. P.

Reports of the First Bilingual Congress of Radiology and Electrotherapy, Continued (four abstracts). Discussion on the Abnormal Stomach. Arch. Radiol. & Electroth., 27:66, August, 1922.

MR. J. MAGNUS REDDING stated that in his practice it was the rule to rely upon the radiogram for confirmation of screen findings and ultimate diagnosis and that screen findings alone would never be considered sufficient.

His discussion dealt almost entirely with "the so-called 'area of localized tenderness' over some part of the stomach or duodenum frequently quoted by the radiologist as confirmatory of a diagnosis of ulcer, or as warranting a suspicion of such a lesion." Diagnosis of gastric and duodenal ulcer, he believes, should depend upon the recognition of the deformity in visceral outline produced by these lesions and he does not believe that tenderness is of any great moment in these cases.

Tenderness never appears over the stomach or part of the duodenum unless the part is adherent to the parietal peritoneum, which condition is not nearly so frequently found as is gastric and duodenal ulcer. In the vast majority of gastric and duodenal cases tenderness to pressure is due to hyperalgesia of the skin, muscles and connective tissue. Even when an ulcer had been positively and definitely located the area of tenderness, if present, does not shift with the change in position of the ulcer which shifts its position to some degree with every change of posture. The only exception to this last statement is an ulcer intimately adherent to the pancreas or anterior parietes. Only in exceptional circumstances and after the most thorough investigation will tenderness ever be found associated with any particular area of the underlying organs.

PROF. M. R. J. HAYS suggested that gross palpation be done with the gloved hand operating through the smallest diaphragm with a minimum amount of current, and that finer palpation be done with the ungloved hand and the current turned off.

DR. ROWDEN said that he considered marked pyloric obstruction with a small stomach in a well nourished individual to be strongly indicative of

malignancy, while the same obstruction with a large stomach in a thin individual he considered to be against malignancy.

He prefers the single meal in examination, observation extending over six to seven hours, to the double meal.

DR. R. CONNELL mentioned the case of a patient whose stomach, while under fluoroscopic examination, was seen suddenly to drop several inches and the next instant the patient had fainted. This illustrates the suspensory action of the oblique muscle fibres of the stomach and shows that there may be a basis of fact back of the "sinking sensation" experienced in fainting.

DR. G. B. BATTEN advocated routine examination, both by screen and plates, first in the upright position and then prone upon the abdomen.

DR. THURSTON HOLLAND in closing the discussion advised both screen and plate examinations and expressed himself as opposed to the standard meal. Each worker must, of course, have a standard meal routine examination, but in individual cases he should use any combination of barium and other things as he sees fit. No one meal can be taken as final in every case.

Problems in Radiotherapy. Robert Knox, M. D., Arch. Radiol. & Electroth., 27:69, August, 1922.

THE MOST urgent problem of deep therapy is the standardization of the dose. The solution of this problem would be well begun if an effect upon a particular tissue could be associated with a particular wave length. After this problem is solved there remains the technique of x-ray and radium treatment.

The Seitz and Wintz "unit skin dose" (U.S.D.) means the amount of radiation which will after eight days produce a slight erythema and will after four weeks produce a slight tanning of the skin. Seitz and Wintz have made the arbitrary figure "100" represent this U.S.D. on the basis of which they have determined the other doses, e. g., 60 to 70 per cent of the U.S.D. is taken as the sarcoma dose, 90 to 110 per cent is taken as the carcinoma dose, etc. The author states that time alone will allow of definite conclusions regarding lethal dosage, although marked advances in technique have been made "and if it were not for the very variable biological response of the tissues the value might be regarded with more certainty." He does not believe that we are on the eve of a certain cure for cancer, as the problem is too deep and too elusive to be so easily solved, but he does admit that greater relief has come from the experience and study of recent years.

The Freiburg and the Erlangen technique requires an overlapping of beams which involves the risk of over-exposure of healthy tissue and in addition to this objection there is the one that treatment has to be suspended from time to time to allow the blood to recover from the effects of the rays.

The staff of the Cancer Hospital of London devised a rotating tube mechanism by which the proportion of the skin dose depends upon the circumference of the circle used. A diminution of skin effect is secured by moving the tube in a circular manner, thereby distributing the dose over an area equal in size to that of the circle. Angling the tube conveys the beam to the focus spot, which hardly varies in extent or depth when the tube is accurately centered. A further step in this technique led to rotating the patient instead of the tube. This is done so slowly that the patient is not conscious of it, an hour or more is required for one complete revolution of the table upon which the patient lies. This makes it possible to completely protect the operator and patient by inclosing the tube in a box lined with thick lead, an oil bath surrounded by lead is preferable.

The skin erythema dose this author regards as a very unsatisfactory basis for the estimating of deeper dosage, and he advocates an endeavor "to obtain a standard biological reaction obtained under standard physical conditions." Closer collaboration between physicists and radiologists may lead to the development of more precise methods. The same tumor varies greatly in its response to radiation at different times in its life history.

Operation whenever possible is recommended. It should be followed by x-rays or radium treatment.

In the discussion of this paper Mr. W. Sampson Handley said that while he did not believe that radiology would ever displace surgery, he did believe it to be an indispensable aid in cancer therapy.

On the Use of Radiotherapy. Drs. R. Proust, L. Mallet and R. Coliez, Arch. Radiol. & Electroth., 27:89, August, 1922.

DRS. Proust, Mallet and Coliez reported the establishment of a department of deep therapy at the Hospital Tenon, Paris. There are separate rooms for deep x-ray therapy and for radium applications, a pathological laboratory where sections are quickly diagnosed, a ward of twenty beds for women and one of sixteen beds for men.

This department of the hospital has been in operation since January, 1922, and 110 cases have received treatment

within that time. The technique has been that used by Caseman and Knox. Promising results have already been secured in various forms of malignancy. The authors of this paper believe that the time is soon coming when deep therapy will be the treatment of choice in all forms of uterine malignancy.

Discussion of Deep Therapy, Arch. Radiol. & Electroth., 27:91, 1922.

DR. SABERTON emphasized the value of cooperation of the physician, surgeon, pathologist, physicist and nurse in all cases where massive dosage is employed and advocated the establishment of institutional treatment in suitable centers.

He emphasized the importance of doing everything possible to increase the patient's powers of resistance before massive treatment is undertaken and also emphasized the importance of after care.

As to the Erlangen school he differs from them in his estimate of the value of previous ionization of the growth with copper salt to increase scattered radiations. Except in the case of ulcerated surfaces he does not believe there is any value in doing this. He also differs from them in his estimation of the so-called stimulating dose to cancer cells, regarding this as a very difficult thing to determine. He favors operative measures whenever possible and believes very strongly that pre-operative treatment is desirable.

PROF. H. R. J. HAYES in his discussion described the use of a simple device, similar to a lavatory seat, for the treatment of superficial perineal lesions. Full description of this method is reserved for later publication in the Archives. He also described a brass catheter one millimeter thick for use in the treatment of the prostate gland.

DR. CURTIS WEBB also favors operative treatment whenever possible, and, like Dr. Saberton, does not advocate previous ionization treatment. He stated that the radiologist should have equal consideration with the surgeon. When the latter has done his best in his efforts to save a patient and failed he receives generous consideration; the same should be true in similar circumstances of the radiologist.

MR. HAYWARD PINCH said that he regarded deep radium therapy by means of buried tubes as the method *par excellence*. Deep radium therapy, he stated, ought to mean the use of two to seven grams of radium applied to one patient, and he hopes to be able to carry out this form of therapy at the Radium Institute in the near future.

Accessory methods of treatment include x-rays, a liberal vitamin B diet and the use of collosol solutions of

heavier metals, especially copper and silver. He has found injections of these very helpful in several instances.

Nausea, malaise and diminished resisting power to bacterial infection, and diminished response to irradiations are all sequelae of radium treatment which offer research problems. He includes here the sequel relating to the internal secretions and states that he does not believe that crossfire can be so concentrated as to effect only the ovaries; he believes that the pancreatic and renal secretions may be disastrously affected by such treatment.

Technical and Clinical Aspects of the New Deep Roentgen Therapy. James T. Case, M. D., F. A. C. S., Am. J. Roentgenol., 9:530, September, 1922

THE RESERVE of the most skeptical must be shaken by the evidence presented in German clinics where the "new" roentgen therapy is being used, even after allowing for overenthusiasm. The reports from these clinics, the writer believes, should be accepted with reserve, but this should be unaccompanied by skepticism.

The writer reports that upon his visits to these European clinics he found "more constant and more pronounced immediate palliation in a larger percentage of cancer cases, and, with some, complete disappearance of signs and symptoms of the disease * * *."

Seitz and Wintz, Opitz and others have completely abandoned operative treatment in cases of uterine cancer, but the writer of this paper does not regard this as a wise procedure just yet, though time may prove it to be so.

Roentgen Treatment of Diseases of the Generative Organs. I. Seth Hirsch, M. D., New York M. J., 116:68, July 19, 1922, and 116:208, August 16, 1922.

THIS ARTICLE, running through two numbers of the above journal, is a very complete and conservative presentation of the subject.

The radiologist is but the assistant of the gynecologist in these cases. He must apply the rays with brains and talent, adhering to certain fundamentals, but remembering that he is dealing with a human being. The gynecologist's function is to select the cases for treatment.

There are five great causes of uterine bleeding—pregnancy, infection, displacements, lacerations, neoplasms and endocrin disturbances. Only the latter two concern the radiologist. X-ray is useful in the treatment of excessive or prolonged hemorrhage, benign tumors, malignancy, sterilization, and diseases of the vulva.

In giving treatment the radiologist must heed certain fundamental considerations, namely the following: Cellular reaction depends upon the absorption of x-rays; the reaction is the same, whatever the wave length, if the energy is absorbed; cells vary in reaction; the lethal dose of certain wave length rays has been established for certain cells, both benign and malignant; both the local effect and the general reaction must be considered when applying the rays; there is no one standard maximum dose.

Through the use of instruments of relative precision the entire technique is being established on a sound scientific basis.

The physical dose is the energy absorbed in a volume unit of substance and is estimated by subtracting the quantity of energy remaining on the under surface of the unit of absorbing medium from that falling on the upper surface. The distribution of the dosage through the mass of the medium is very different, and in treating human tissues, many factors besides the physical dose must be considered.

Since the skin is the great barrier and must be conserved, the estimation of the erythema dose is necessary.

The biological dose is the physical dose multiplied by the sensibility coefficient of the tissue. The deep biological reaction is now measurable by the ionization chamber. The biological dosages of Seitz and Wintz are quoted, with the remark that they must not be accepted as absolute.

The dose quotient is the ratio between the surface dose and the deep dose, and the aim of deep therapy technique is to keep this quotient as small as possible, aiming to get as high a deep dose percentage as possible. The value of the dose depends on three factors: (1) The absorption of rays by overlying tissue. The dose quotient is smaller the more penetrating the radiation and the more homogeneous the rays by heavier filtration. (2) The dispersion of the radiation. The dose quotient is smaller the farther the source of radiation. (3) The scattering of the radiation. The dose quotient is smaller the greater the scattering, and this is increased by increasing the focal distance and enlarging the size of the portal. These three factors are discussed in detail by the author.

The x-rays should be centered upon the organ they are designed to affect. In gynecology, it becomes necessary to determine the relative position of the ovaries to each other and their projection upon the surface of the body, together with the depth of the ovaries from the abdominal wall. In the average case a square three centimeters in

size with its inner border three centimeters from the median line, and its upper border at the interspinous line, will, in ninety per cent of the cases, include the ovary. The average depth is six and a half centimeters on the right and six centimeters on the left. The ray must be so gauged, then, that it will be administered at a depth of six centimeters in the square mentioned.

The uterus in carcinoma is considered to be ten centimeters below the surface.

With the older technique of numerous small portals and crossfiring, sterilization was easily accomplished, since the necessary thirty-four per cent was easily delivered to the ovaries, but malignancy was hardly affected. A complete revision of this technique has been made, and treatment is given through larger portals and the aim is to deliver to a selected area beneath the surface a definite dosage. This may be given by complete dosage at one session, or by divided dosage through several sessions. In determining these, both the local changes in the pelvic organs and the systemic response must be considered.

In carcinoma it is a great advantage to administer the desired dosage within as short a time as possible. Since many patients cannot stand the necessary eight to twelve hours, at one session, it may have to be spread over two to four days; it can be further shortened by radiating by two or more tubes simultaneously. However it is given, when the full skin dose has been given through each skin area, the series is complete and it becomes necessary to wait until both skin and systemic reactions subside.

Myopathic hemorrhage requires a careful selection of cases, because while radiotherapy is effective and will produce amenorrhea, this is not always desirable. In women near the menopause and having climacteric hemorrhage, radiotherapy is the best treatment.

In fibromyomata, there are three theories as to the mechanism by means of which radiation will reduce the size of the tumor: (1) an artificially produced atrophy similar to that which occurs at the menopause; (2) direct action on the muscular tissue; (3) endarteritis thereby starving the tumor. The factors to be considered in determining the mode of treatment are: age of patient, characteristics of tumor, complications.

In general it may be stated that hemorrhage due to fibroids should be treated by radiotherapy in those women in whom a permanent menopause is not objectionable. Even if severe, the menopausal symptoms are to be preferred to an operative risk, since the

symptoms can be fairly controlled by organotherapy.

The old technique of many small fields has given way to that of larger fields and heavier filtration. With a peak voltage of 200,000, 5 ma. at 35 cm. distance, filtered through 0.5 mm. of Cu and one mm. of Al, the treatment is administered through four fields, two abdominal and two dorsal, in four sessions within two to eight days and at the end of the menstrual period. Fifty per cent of the full skin dose is applied to each portal. When radium is used as a substitute for x-rays, 50 mg., properly filtered, are inserted into the uterine cavity for twenty-four hours, or less, depending on the patient's age.

The gynecologist must weigh the advantages and disadvantages in determining whether radiation treatment shall be used. The advantages are that the treatment is painless; in properly selected cases there are no failures; the menopause is not usually attended by any severe nervous symptoms; treatment takes one to eight weeks, and if it fails operation is still available; there is no mortality if the cases are properly selected. Disadvantages: There is a definite time period before a cure is effected; the fibroid may only partially disappear and, in rare cases, may recur; malignant changes may be present and be overlooked, or malignant changes may take place in the fibroid. The crux of the entire treatment of fibroids by radiation is correct diagnosis.

In carcinoma, the patient to be submitted to radiation must be considered in the same light and from the same viewpoint as the patient about to undergo a severe surgical operation, as far as regards preliminary management, radiation and postradiation treatment.

The technique of successful radiation for cancer demands: (1) radiation of the proper quantity and quality; (2) the administration of the lethal dose of this radiation to all cancer cells at the varying depths at which they exist; (3) the administration of this dose in such a manner that the local resistive power of the normal cells about the cancer are not depressed and the general resistance of the whole organism is not appreciably lowered. The question of the lethal dose of the cancer cell is not a simple matter, and any sweeping statement with regard to cancer dosage must be taken with caution. The clinical study of the case is now the sole guide in the determination of the size and frequency of the dose.

The author discusses the technical difficulties in connection with treatment of uterine carcinoma, and the use of radium as an adjuvant, detailed discussion of which cannot be given here.

Sterilization is indicated in (1) dysmenorrhea which is not infective, the dosage in this condition not being sufficient to produce complete castration; (2) after Caesarian section; (3) in osteomalacia; (4) in severe tuberculosis; (5) where social reasons are sufficient to make the measure justifiable and permissible.

W. W. W.

Treatment of Cancer of the Breast.
Frederick H. Kuegle, M. D., Minnesota Med., 5:888, October, 1922.

SINCE, even with the best of surgery, the ultimate history of breast malignancies is anything but encouraging, the attention naturally turns to the value of radiant energy as an adjuvant to surgery in such cases. The question is considered under three headings: (1) as a pre-operative measure, (2) as a post-operative measure, (3) as a palliative in recurrent and inoperable cases.

From the best figures available, an established breast cancer with palpably affected axillary nodes, has about one chance in 25 of being cured by operation. If intensive x-radiation is administered by approved modern technique there will be marked recession of glandular enlargements, the cancer cells will be killed or encapsulated, the smaller lymph channels will be obliterated and tendency to metastases lessened. These are all desirable accomplishments, and if a period of three to four weeks is then allowed to elapse, operation will be attended with a minimum risk.

Statistics show that more than one-half of all operated cases recur within four years, so that any method of treatment which can be used as an adjuvant to surgery, and which will retard this high percentage of recurrence, should be used. Every case of breast cancer which is operated and confirmed by pathological examination should, therefore, receive postoperative x-ray treatment. Properly administered this treatment will give definite results; any deep-seated cancer cells which have escaped the knife will be killed outright, or be so attenuated in virulence that they can become encysted. The operative scar will be rendered soft and pliable and entirely painless.

As a palliative in hopeless cancers, no other known treatment approaches the usefulness of radiotherapy in relieving pain and foul discharges and in making the terminal stages comfortable.

W. W. W.

Radium in the Treatment of Diseases of Women. W. H. B. Aikins, M. D., L. R. C. P., F. A. C. P., New

York M. J., 116:340, September 20, 1922.

IN CANCER of the breast, it is now generally conceded that pre-operative raying is most important; also every patient whose breast has been removed for cancer should have postoperative raying, which may be given early before the sutures are removed. All inoperable cases should be given the chance which radiation affords.

In chronic mastitis, it would appear that radiotherapy justifies a change from the former stand that operation should be done to prevent carcinoma.

In carcinoma of the cervix, the tendency is away from operation; Ochsner set the pace by announcing in 1921 that he was no longer operating cervical carcinomas. In all stages radium gives results superior to those of surgery. The author prefers comparatively small doses of radium, the total amount being from 1,500 to 2,000 milligram hours, repeated in six weeks if necessary.

The effect of radium on fibroids has been so definitely established as to make radium a specific for certain types of this condition. The author has treated sixty cases with constant results, namely, cessation of abnormal bleeding, resulting in menopause in many cases, marked decrease in size of the tumor, and a marked improvement in general well-being. Smaller doses at six weeks intervals are preferred.

The effect of radium in leukorrhea is often remarkable, several cases cleared up entirely under radium treatment.

In menorrhagia and metrorrhagia not associated with fibroids, most brilliant results are obtained; when these symptoms are caused by hemorrhagic metritis, uterine sclerosis or fibromata, radium will produce a cure; it is a "true uterine styptic."

W. W. W.

Carcinoma of the Cervix. B. C. Garrett, M. D., New Orleans M. & S. J., 75:165, October, 1922.

ASURGEON'S ideas of the place of radium in the treatment of cervical cancer is given in this paper.

While recognizing the fact that many very capable men have stopped operating upon cancer of the cervix in any stage, the author has not been convinced that radium should supplant surgery in early involvement.

Where the involvement has extended beyond the cervix, the author has discarded the cautery and uses radium, followed in suitable cases by surgical removal.

In the far advanced cases, radium is palliative, while surgery is not indicated at all.

W. W. W.

Teratomas and Their Relation to Age. H. E. Himwich, *Cornell University, Medical College*; J. Cancer Research, 6:291, October, 1921.

TERATOMAS are defined by the author as "tridermal embryonal rests endowed with a certain amount of possible growth, that is, growth potential." If the rest is comparatively large, considerable growth potential has been consumed before birth; smaller rests have a slight early growth followed by inhibition and, should conditions permit, they have a later postnatal growth.

"The growth of the host inhibits that of the embryonal rest and the number of teratomas appearing in any given time varies inversely with the growth potential of the host and directly as that of the embryonal rest." Teratomas appear most commonly at the period when the host's growth stops, namely, at from 23 to 29 years of age.

If growth starts because of trauma then malignancy is far more apt to result than in growth resulting from simple growth potential; also, the teratoma is frequently monodermal. If a developed inclusion is traumatized the cell will often be like that of acquired cancer, but if the inclusion is undifferentiated the cell is more apt to be of an embryonal type.

"The curve of carcinoma testis rises and falls in a manner similar to that of teratoma testis and not like that of old age cancer. This is another fact which may be adduced in support of the theory that carcinoma testis is a one-sided teratoma. In the female a similar neoplasm might be expected to arise as the result of the physiologic stimulations of puberty. This is what actually takes place, hence the growth is, in all probability, of teratomatous origin."

*** * * In the old inhibition of the organism is almost negligible. Hence trauma at that time may readily be followed by an uncontrolled and therefore excessive growth. Thus, loss of growth restraint may be almost as important a factor in the etiology of acquired cancer as in that of congenital inclusions."

The bibliography is a guide to extensive reviews of the subject.

An Atypical Adenoma of the Pancreas Originating in Islet Tissue. Harry Goldblatt, *Western Reserve University School of Medicine*; J. Cancer Research, 6:277, October, 1921.

TRUE simple adenomata of the pancreas arising from the islands of Langerhans are very rarely found and the diagnosis is difficult to establish. All such tumors heretofore described in

the literature have been very small, the largest being 11 mm. in diameter.

The adenoma occurring in the author's experience measured 4.5 by 3.5 by 2.5 cm. and was imbedded 10 cm. from the tip of the tail of a pancreas whose total length was 15 cm. The patient, a woman 55 years of age, had for two years been troubled with looseness of the bowels, which finally developed into a severe diarrhea, the effects of which did not, however, confine her to her bed until two months before her death. Indigestion of various food elements (fat, meat and banana) was noted at different times, but no laboratory examination of stools was made. The clinical examination showed no abnormality of lungs, heart, abdomen or nervous system, but at autopsy in addition to the tumor findings there was found slight chronic interstitial nephritis, fatty metamorphosis of the liver, subacute enterocolitis, and slight passive congestion of lungs, liver, kidneys and intestine.

The tumor was found to be definitely and completely encapsulated with no signs whatever of direct invasion or of metastasis. There were no mitotic figures. The general arrangement of the tumor was not unlike that of some cellular adenomata found in other organs of the body. The cells of the tumor very closely resembled those of the islands of Langerhans in their size, shape, staining characteristics, and the minute structure of cytoplasm and nucleus. It was, therefore, deduced that the tumor was benign.

Report of a Case of Leukemia Cutis and Treatment of Four Cases of Leukemia with Radium and X-ray. Texas State J. Med., 18:158, July, 1922.

AN ENORMOUS spleen and general adenopathy was present in the first patient here reported, who came for treatment in September, 1920. A diagnosis of splenomyelogenous leukemia was made and radium treatment was applied over the spleen, and x-rays over the long bones. Three series were given. After one year the patient returned with skin manifestations; the underlying condition was again treated and the condition after four months' treatment again returned to a satisfactory stage.

Three other cases are given in some detail as to blood findings and clinical course, but lacking technical information as to the radium and x-ray applications. The author agrees with Ordway that radiotherapy is the safest and most prompt palliative measure in chronic leukemia, and radium frequently will affect cases which are refractory to benzol or x-ray.

W. W. W.

Carcinoma of the Antrum. D. Crosby Greene, M. D., *Am. J. Roentgenol.*, 9:591, September, 1922.

RESULTS to date in 84 cases of carcinoma of the antrum treated at the Huntington Memorial Hospital are reported in this paper. The data are as follows:

Method of Treatment	Not Treated	Well	Dead	Recurse	Worse
None	6	2	..	4	..
Operation	8	2	1	5	..
Radium	32	7	1	24	..
Op. & Rad.	37	2	12	19	3

Of the 19 deaths listed in the last set of figures, 11 were from recurrence, 3 from metastasis without recurrence, 3 from meningitis following operation, 1 from hemorrhage following operation and 1 from a disease in no way connected with the original trouble.

Of the 12 listed as well after post-operative treatment, the period of time free from recurrence varies from one to five years since operation.

Syphilis of the Colon. J. P. Keith, M. D., *Southern M. J.*, 15:709, September, 1922.

SYPHILIS of the colon is not so rare as the infrequent mention of it in the literature would lead one to believe, according to the experience of this author, and he submits three case reports.

The main difficulty in diagnosis is in differentiation between malignancy and tuberculosis. A gumma with ulceration may give a radiographic picture very similar to that of malignancy. Where the syphilitic stricture is smooth, especially if it is multiple, the absence of pain and of a positive Wassermann are aids in differentiation. Tuberculosis usually involves the cecum and ascending colon, while syphilis is more likely to occur in the transverse and descending colon. Syphilis does not have the intolerance to filling that tuberculosis has.

W. W. W.

Ultraviolet and X-ray as Physiologic Complements in Therapeutics: A Newly Established Clinical Treatment. C. M. Sampson, M. D., *Am. J. Roentgenol.*, 9:570, September, 1922.

AN ACTINIC erythema imposed upon a skin surface which has just received a dermatitis dose of x-rays is, according to many roentgenologists, against all rules of the game. The writer replies to this that he has followed just this procedure for a number of years and he has yet to find a case of depilation or any symptom indicative of dermatitis.

The skin is the natural filter which nature has provided against harmful effects of the sun, but at the same time

this natural filter is permeable to advent actinic effects.

The epidermal pigmentosis which follows an artificially induced ultraviolet burn reacts in such a way "that the area involved, when exposed to relatively soft rays, permits of the assimilation by that part of a greater quantity of physiologic roentgen radiation, at the same time precluding the physiologically detrimental effect that would otherwise be produced on the area of skin unexposed to intense actinism."

The principle derived from the foregoing facts is that x-rays closely allied to ultraviolet activity can exert their helpful influences without exercising their harmful ones. "Ultraviolet and x-rays are physiological complements. The one may be used in symbiosis with the other. That is, the ultraviolet applied first renders the area more resistant to the subsequent radiation with the roentgen rays. The roentgen rays applied first may produce a dermatological change injurious to the organism; but the effects of that in jury can be alleviated or entirely neutralized by applying secondarily the ultraviolet radiation."

Roentgen Therapy of Hyperthyroidism. I. W. Jenkins, M. D., *Texas State J. Med.*, 18:213, August 1922.

RADIOETHERAPY is applicable only to the exophthalmic or hyperplastic and the toxic adenoma. All other forms should be treated surgically or medically. In selecting the kind of treatment Holmes' classification is useful, namely: (1) colloidal, cystic or simple goiter; (2) malignant goiter; (3) toxic adenoma; (4) nontoxic adenoma; (5) exophthalmic goiter.

In malignant goiter, if operable, surgery should be used, preceded and followed by radiotherapy.

Always there should be a thorough physical examination, since hyperthyroidism may be a secondary manifestation of some focal infection. When menstruation is excessive without detectable pathology, raying the ovaries is indicated. Clinical improvement precedes a change in basal metabolism.

This paper was part of a symposium on goiter held by the Surgical Section of the Texas State Medical Association, at El Paso, May 10, 1922.

W. W. W.

Roentgen Treatment of Toxic Goiter. E. W. Rowe, M. D., *Nebraska M. J.*, 7:329, October, 1922.

TREATMENT of toxic goiter by x-ray came into vogue in 1905, but fell into disrepute because many patients seemed worse rather than better after this mode of treatment. Lack of knowl-

edge of the etiology of the disease, faulty technique and inadequate apparatus were the factors accountable for this failure, but within the past few years all this has been changed.

The etiology of the disease and its treatment are all discussed in the original paper and a bibliography of the recent literature is appended.

The author thus sums up his conclusions: "(1) Properly selected cases are as rationally treated by roentgen rays as by surgery. (2) Adolescent toxic cases and early toxic cases yield most readily. (3) Adenoma with toxicity yields less readily, but often gives brilliant results. (4) Exophthalmic goiter shows the best results of all, and if roentgen treatment is faithfully carried out it seldom requires surgery, while the results are just as permanent. (5) Malignancy is no contra-indication. Pfahler reports two cases permanently cured. (6) There is no harm in the treatment and many are cured. (7) There is no fear of operation, less likelihood of recurrence, and no defacing scar on the neck. (8) Three series may effect a cure. Sometimes six or eight are required. (9) The tonsils when infected should, with other foci of infection, be treated. The tonsils may be treated at the same time by the roentgen ray with high probability of relief. (10) Treatment should be given only by or in cooperation with an experienced clinician. (11) The estimation of the basal metabolic rate in the selection of cases will determine the thyroid activity better than any other method. It will help also to visualize the progress of the patient and give a safe indication when treatment should be discontinued."

Differential Diagnosis and Treatment of Some Pulmonary Diseases with Special Reference to Artificial Pneumothorax. Louis Mark, M. D., *Ohio State M. J.*, 18:544, August, 1922.

THE pulmonary conditions which are frequently incorrectly diagnosed as tuberculosis are considered in this paper. In the differentiation of carcinoma, syphilis and abscess of the lung the x-ray findings, when carefully interpreted, aid very materially.

In the initial stage primary carcinoma is usually diagnosed as tuberculosis. Many cases of pulmonary syphilis have been seen by the author during the last few years.

Careful history and careful physical, laboratory and x-ray examinations are all necessary for differentiation of these lesions from tuberculosis.

W. W. W.

X-ray Diagnosis of Diseases of the Lungs. Amedee Granger, M. D., New Orleans M. & S. J., 75:107, September, 1922.

NORMAL lung tissue can be accurately revealed by the x-ray film, but the radiologist must be familiar with normal lung markings and with the characteristic density of the normal lung tissue.

Excluding acute pneumonic infections, tuberculosis is the most common lesion and it must be excluded before any other diagnosis can be substituted. The earliest recognizable lesion of adult tuberculosis is the Dunham fan, usually found in the apical region along the first or second interspace branches. It is formed when the inflammatory exudate at the point of inoculation with the tubercle bacilli, fills the air cells and terminal bronchus of a secondary lobe. Dunham believes that the presence of two or more of these fans of different densities in the location mentioned constitutes a lesion which is pathognomonic of tuberculosis. After the apical lesion the most common one is caseous bronchopneumonia, which usually first invades the upper lobe above the second interspace—then the upper portion of the lower and median lobes—then the lower part of the upper lobe. It may become confluent. Both lungs may be involved, but not to the same extent, as a rule. Acute miliary tuberculosis presents a characteristic picture, with fine studdings more or less evenly distributed throughout both lung fields; the history and clinical picture are necessary to differentiate these from pneumoconiosis. Basal tuberculous lesions without apical lesions are rare, and occur mostly in children.

Watkins has found 172 cases of pulmonary syphilis in 6,500 examinations of the lungs and heart, and 209 cases of syphilis complicating advanced tuberculosis. The types of radiographs may show the following lesions, gumata with syphilitic peribronchial densities, syphilitic peribronchial densities; bronchostenosis with lung collapse and marked deformity. Syphilis and tuberculosis may occur simultaneously in the same chest.

Primary sarcoma is usually lymphosarcoma and is shown as a large single shadow; secondary sarcoma may appear as large or small, usually multiple, rounded circumscribed shadows. Metastatic carcinoma gives fairly regular shadows, apt to be limited to the hilus region. Primary carcinoma is less frequent, but presents a characteristic picture. The invasion may be either infiltrative or milary.

Cysts may be either echinococci or dermoid.

Jarvis has shown five stages of pathologic lesions in granite cutters, namely, (1) increase in hilum width and density, (2) increase in trunk markings, (3) densities at the branching of bronchi, (4) appearance of fans indicating accumulation at the periphery, (5) homogeneous haze at the lung periphery.

The writer's technique is to make two 14 by 17 films, one postero-anteriorly and the other a left lateral view, both at a distance of six feet.

W. W. W.

Tubercular Epiphysitis of the Greater Trochanter. D. Y. Keith, M. D., Am. J. Roentgenol., 9:549, September, 1922.

THIS is a report of a tumor occurring over the right hip of a boy 12 years of age. Six months before the roentgen examination the patient had fallen upon this hip and there had been resultant soreness and lameness for about three months following that time.

The roentgen examination showed bone destruction on the superior and external aspects of the epiphysis of the trochanter. This destruction extended to the external part of the adjacent diaphysis for the distance of one centimeter and it ended in a spur of bone about one centimeter in height. In the soft structures above the right trochanteric epiphysis there appeared a shadow measuring two and one-half by five centimeters. It was much more dense than the surrounding soft structures but much more radiable than normal bone and later in the history of the case it was found to be the wall of an abscess cavity.

Roentgen diagnosis was: (1) Neoplasm, destructive sarcomata; (2) Osteomyelitis, probably tuberculous. Clinical and surgical diagnosis gave degenerative sarcoma. Microscopic examination showed a number of tubercle bacilli in nearly every section, but no evidence of neoplasm.

Recovery after operation has continued to be very satisfactory to date (June 15, 1922).

"The epiphysis of the greater trochanter is not different than the epiphyses in other locations and is probably more frequently infected with tubercle bacilli than has been reported in the literature. Bone infection is certainly more frequent than new growth.

"In this case bony changes were noted by roentgen ray examination sixty days after injury, though no diagnosis was made by roentgenologists of unquestioned ability and very wide experience."

Roentgen Ray Diagnosis of Tubercular Cervical Lymph Glands. John

Munn Hanford, M. D., Am. J. Med. Sci., 164:539, October, 1922.

CALCIFICATION in tubercular glands of the neck is said, by good authorities, to be rare, but the author does not agree with this view and he states that "a positive diagnosis of tuberculous cervical glands, abscesses and sinuses may be made so frequently by a small plate, studied with the clinical picture, as to render the roentgen ray worth a trial before subjecting the patient to a biopsy."

In his practice 200 cases of tuberculous cervical glands have come under his observation and treatment during the last three and one-half years. X-ray plates of the necks of forty unselected patients from this total of 200 showed definite areas of unusual density in 21 of the 40, and these areas corresponded in location to the lesions found upon physical examination. Ten of the 21 were pronounced tuberculous by microscopic examination and the other 11 were clinically typical of tuberculous glandular cases. There was no doubt about seven of these, the other four presented cold abscesses which contained caseous matter and which persisted as sinuses.

These 21 positive plates show that beyond all reasonable doubt tuberculous cervical lymph glands may give evidence of calcification, "and, conversely, that the evidence of calcification, studied in conjunction with the clinical findings, spells tuberculosis." Also it shows that occurrence of this lesion is sufficiently frequent with tuberculous lesions of the neck to warrant the routine use of the plate. Even though there is a good chance of the findings being negative, one plate should be made; a small one fitting snugly against the back of the neck between the occiput and the second dorsal is more apt to pick up the smaller shadows than is a larger plate. One anteroposterior view is sufficient, lateral views are rarely helpful.

Roentgenography of Intracranial Passages Following Spinal Air Injections. Charles L. Martin, M. D., and Claude Uhler, M. D., Am. J. Roentgenol., 9:543, September, 1922.

INJECTION of the subarachnoid space with air appears to be a relatively safe procedure where the cases are properly selected. Brain tumor in the posterior fossa is the most important contraindication to this procedure. "The after effects of the injection are not serious. The proper interpretation of roentgenograms of the skull made following such injections should aid ma-

terially in improving the mortality statistics now credited to brain surgery."

The Effect of Radium on the Normal Tissues of the Brain and Spinal Cord of Dogs, and Its Therapeutic Application. Eugene P. Pendergrass, M. D., J. M. Hayman, Jr., K. M. Houser, and V. C. Rambo, Am. J. Roentgenol., 9:553, September, 1922.

THIS PAPER gives the results of an experimental study "of the effects of radium radiation upon the normal tissues of the brain and spinal cord of dogs, both by application and by implantation" and discusses the therapeutic application of x-rays and radium.

Clinical symptoms and gross effects are considered. Microscopic study is limited to a practical consideration of the depth of penetration of the rays. A more intensive microscopic study is contemplated which shall compare these microscopic findings with known lesions of the brain and cord.

A review of the literature which deals with the effects of radium upon lesions of the central nervous system occupies several pages of this study (the bibliography includes 71 references to the literature of the past 25 years) and a detailed account of the writer's experimental study then follows:

The author's conclusions, drawn from this study, are: "(1) An exposure of the normal brain tissue up to 1,150 mgm. hours is compatible with life (surface application). (2) The results on the cord, however, would indicate that exposure of vital areas of the brain as well as exposures of the cord should never be made by surface application or by implantation. (3) Microscopic studies indicate that considerable changes are to be found with exposures that give no clinical symptoms. (4) The brain after exposure of 1,000 mgm. hours shows a general swelling throughout the entire radiated hemisphere, which, from our studies, must be ascribed to the production of an edema which is not limited to the radiated area, but extends throughout the entire hemisphere. (5) Radiation of the brain by radium (surface application and implantation) can produce severe general symptoms which indicate that a powerful toxin has been produced from the radiated tissue. (6) The effect of radium is due to a twofold action, first, an effect upon the nucleus and cytoplasm of the cell, which causes, secondly, the death of the cell under conditions favoring autolysis. The direction of this autolysis is determined by the chief component of the radiated cells. If this be protein the toxic products of proteolysis may exhibit their general effect. If the chief component

be lipid compounds, we believe that the resultant autolysis may free the toxic components of lecithin, and produce their characteristic reactions. (7) The use of radium as a therapeutic agent in the treatment of brain tumors is recommended, but should be undertaken only after one is thoroughly familiar with the dangers that may come from improper use thereof. (8) We believe that our experiments on the dogs are applicable to human beings because it is not the destruction of brain tissue that causes death, but some toxemia, and in the application of radium in the treatment of malignant tumors of the brain of humans the normal brain tissue should not receive more than 1,150 mgm. hours."

Directions are given for therapeutic application in cases of inoperable growths, partially removed growths, growths not localizable, growths infiltrating the brain substance, and spinal cord tumors.

"Radium is recommended (1) as a prophylactic against recurrence after removal of brain tumors; (2) as a prophylactic against recurrence after sella decompression; (3) as an active agent in the treatment of cases of recurrent visual disturbances after sella decompression has been performed; (4) as an active agent by direct implantation into inoperable tumors supplemented by crossfire radiation through the scalp (external application); (5) as an active agent where brain tumors are only partially removed, by implantation of radium into the center of the cavity, and supplemented by crossfire radiation externally; (6) as an active agent by crossfire radiation (external application) in brain tumors which cannot be localized or discovered by operation. (7) Treatment of spinal cord tumors should be restricted to crossfire radiation by the roentgen ray or radium, as in surface application there is a great possibility of causing paralysis."

The Significance of Nasal Polyps. H. G. Shirley, M. D., South. M. & S., 84:369, July, 1922.

THE CLINICAL picture varies widely. The patient may be in perfect health, but most often he is anemic, undernourished, nervous and irritable. Chronic pulmonary changes may be present.

Illustrating the frequency with which nasal polyps are missed, St. Clair Thomas is quoted as saying: "Mistakes made are probably more frequent than in other of the ordinary affections of the nose and are only equaled by the frequency with which polyps are overlooked."

Polyps will be found most frequently springing from the anterior end of the

middle turbinate, and when so present infection in the antrum should be looked for. In diagnosing polyps in the antrum the x-ray is an invaluable aid, as it may show polyps when transillumination does not and when irrigation gives negative findings.

A number of sinus radiographs illustrate the original article.

W. W. W.

An Analysis of the End-Results of Tonsillectomy and Adenoidectomy. Samuel A. Blaurer, M. D., and Samuel Z. Orgel, M. D., New York M. J., 116:142, August 2, 1922.

THIS ARTICLE is of interest to radiologists who have to answer the oft repeated statement that x-ray treatment of the tonsil is not effective. The stand of the radiologist might well be that radiotherapy will dispose of the infection arising from the tonsil; if the distant ailment which is supposed to be caused by this infection is not cured, it probably has no connection with the tonsil (Abstractor's note).

To see whether the expected results had taken place, and also to determine whether removal of the structures had had any detrimental effects the authors analyzed one hundred cases of tonsillectomy and adenoidectomy.

The causes for removal were as follows: Frequent colds, 55; mouth breathing, 44; malnutrition and anemia, 16; tonsillitis, 18; otitis media, 9; asthma, 4; cardiac lesions, 4; advice of school nurse, 7; stunted growth, diphtheria and chorea, 1 each.

Of the 55 cases operated for colds 51 per cent showed no improvement. Of the 44 cases operated for mouth breathing about 33 per cent were relieved of either the primary symptom (colds) or the secondary symptom of mouth breathing.

Of the 16 malnutrition cases only 25 per cent proved to be in good general condition.

Of the eighteen cases of tonsillitis 83 per cent gave no further tonsillary symptoms. In clinical tonsillitis with a follicular exudate associated with rheumatic tendency the indications for removal are the clearest, the purpose being the removal of the source of rheumatic infection.

Of the 9 cases of otitis media 67 per cent were cured. The other three cases were uneffected. The indications for removal of the tonsils and adenoids in chronic otitis media are clear.

No improvement was seen in any of the four asthmatic cases. Results in the four cases of cardiac lesions seemed to justify operation. The seven children operated upon by advice of the school nurse were healthy before operation, but four of them were not as well after-

wards. The one diphtheria carrier was converted into a non-carrier.

W. W. W.

Statistics and Technique in the Treatment of Malignant Neoplasms of the Larynx. Douglas Quick, M. B. (Tor.) and F. M. Johnson, M. B. (Tor.), *Am. J. Roentgenol.* 9:599, September, 1922.

THE USE of radium in the treatment of carcinoma of the larynx cannot yet be regarded as an established method of treatment, but experience holds out the hope that it will become such.

A series of 156 cases have been thus treated at the Memorial Hospital during the last five years. Twenty of these were primary operable intrinsic carcinomas. Four of these were complete failures, seven are clinically well, seven are making good progress, one was at first improved, but has been lost track of and one, owing to unsuitable radiation, required subsequent operative treatment and is now well, but, of course, cannot be counted among the radium cures.

The author's summary is as follows: "(1) While radium offers hope to a larger number of cancers of the larynx than the older methods, its use must be considered to a certain extent experimental as yet. (2) Before treatment of a laryngeal neoplasm is undertaken, proper classification, based on what can be reasonably hoped for, should be made, and the method and intensity of treatment governed accordingly. (3) While treatment of primary operable intrinsic cancer of the larynx is permissible, the evidence to date does not warrant advocating it as the agent of choice. (4) It is suggested that the pre-operative use of radium in operable cases would add materially to the end-results. (5) Surgical exposure may frequently be used to advantage in radium localization. (6) The radical use of intensive radiation is permissible in cases offering a reasonable hope for complete recovery. (7) The conservative use of radium in inoperable cases offers palliative relief in a large percentage. (8) Radium should be withheld in the very advanced cases."

Treatment of Nasal Polyps by Radium. Horace R. Lyons, M. D., *Am. J. Roentgenol.* 9:584, September, 1922.

THE MAYO CLINIC three years ago undertook the postoperative radium treatment of nasal polyps. Since no permanent cure has yet resulted from any form of treatment this postoperative treatment was determined upon in the hope that stimulation of fibrous tissue growth in the recurring polyps would make a second operation more successful.

As yet experience with this form of therapy has not been sufficient to allow of definite conclusions with regard to its effects, but the results in the 55 cases so far treated show that radium lengthens the intervals between recurrence and that definite operative cures occur more often when radium is used. It has no effect however upon a suppurative sinus disease which must be eradicated for a permanent cure to follow.

At first radium burns were feared and great precaution was exercised in its administration, but it was found that 200 mg. hours at weekly intervals, not oftener, did not produce a burn. It is stated that postoperative weekly treatments of 150 mg. hours can be continued indefinitely without a resultant burn.

Applications are begun the second or third day following operation. The radium is screened by thin silver tubes surrounded by sterile rubber from a finger cot.

Three cases are reported in detail.

Sunlight Against Death. C. W. Saleeby, M. D., F. R. S., *World's Health* (Red Cross), 3:416, September, 1922.

BAYLISS is quoted as saying that he is quite convinced from his observations of work done in American institutions that ultraviolet light cures and prevents rickets, both in children and animals. The author makes a marked distinction between light and heat in their therapeutic effect. Light is beneficial, but only when heat is not excessive. "Solar heat paralyzes, solar light stimulates."

"Dirty, smoke-polluted air * * * is opaque to rays of just those wave lengths (in the ultraviolet not far from the visible spectrum) which Lodge and Marshall Ward found to be most lethal to anthrax bacilli." Coal smoke has an almost specific action in filtering away the antiseptic solar rays, but more important than this, he believes, is the loss of the effect of the specific absorption of light by the blood.

His plea is not so much for the therapeutic use of ultraviolet rays or sunlight as for the protective use of sunlight. He calls rickets and tuberculosis "diseases of darkness" and he characterizes Sheffield as "that smoke-cursed, rickets-and-tuberculosis haunted survival of 19th century industrialism and waste at their worst." Great Britain's next great hygienic task is "the restoration of sunlight to our malurbanized millions, now blackened, bleached and blighted in slums and smoke."

Cinematographic Evening. J. Roentgen Soc., 18:176, October, 1922.

THIS is an interesting account of a "movie" attended by the Roentgen Society last May.

The films were produced by the Radium and Chemical Company of Pittsburgh, Pa., and the first one depicted the mining of carnotite ore in Colorado and its transportation from there to Pennsylvania.

Five hundred tons of this ore contains on the average one gram of radium. European ores contain one gram of radium to every five or six tons, but the supply of ore is limited. The mining of this low grade Colorado ore was conceived by the late Joseph N. Flannely, to whom, therefore, belongs the credit of giving the world all the radium it needs.

The ore is first reduced one-fourth in bulk at the concentration mill and is then sacked and carried 65 miles by horses and motor to a narrow gauge railway, by which it finally reaches the main line, then travels 2,300 miles to the company's reduction plant in Pennsylvania, where it is reduced to a crude barium bromide. thence it is sent to the company's research laboratories in Pittsburgh.

A second film showed the production of metallic tungsten, the preparation of the cathode and anode of the tube, the exhaustion of the bulb and all the other arrangements for x-ray production. The nature of the rays was brought out by the lightning line-drawing methods used ordinarily in "the funnies." Abstruse phenomena of physics were delineated with essential accuracy.

Dr. G. H. Rodman, the chairman of the evening, remarked that much good would come from the release of these films for popular consumption.

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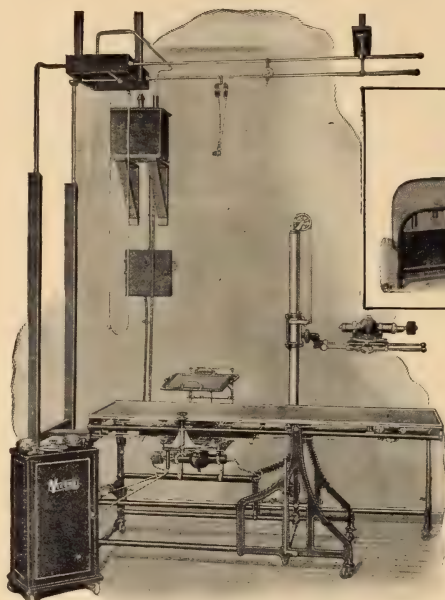


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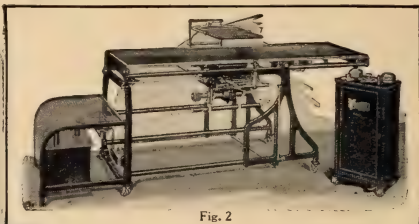


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Roentgen Table—Model 9*

any other Victor Stand) same can be adapted to the table—another instance of Victor standardization.

Fig. 2 shows it again with the Stabilized Unit, for fluoroscopy only. Note the high tension transformer on frame at end of table, in this instance eliminating the overhead system; the control stand right at the side of the operator. Consider the advantage of working with the Stabilized Unit, which insures a constant tube current regardless of fluctuations in the line current. This feature is found exclusively in Victor apparatus and is one of the most important developments in recent years.

The many practical combinations possible with this new table, in view of equipment already installed in the laboratory, are explained in a special bulletin which will be sent on request.

VICTOR X-RAY CORPORATION, Jackson Blvd. at Robey St., Chicago

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While in Europe, for travel or study, you might profitably call at our office in Berne, Switzerland, Effingerstrasse 6 a



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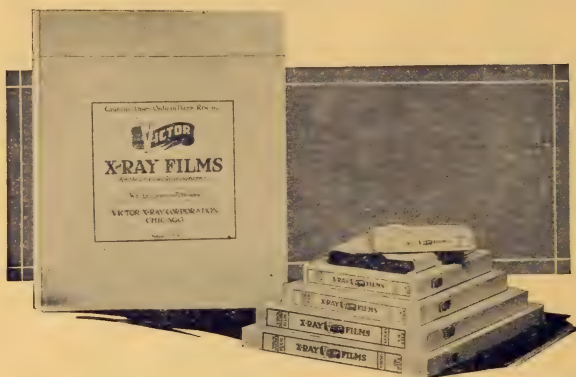
VOL. III

FEBRUARY, 1922

No. 2



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Announcing Victor X-Ray Films

A superior film, remarkable for speed, density and contrast. The critical radiographer will be pleased with the clean, clear, crisp negatives. Emulsion on both sides. Order yours now—results will convince you. Look for the “Victor” trade mark in green.

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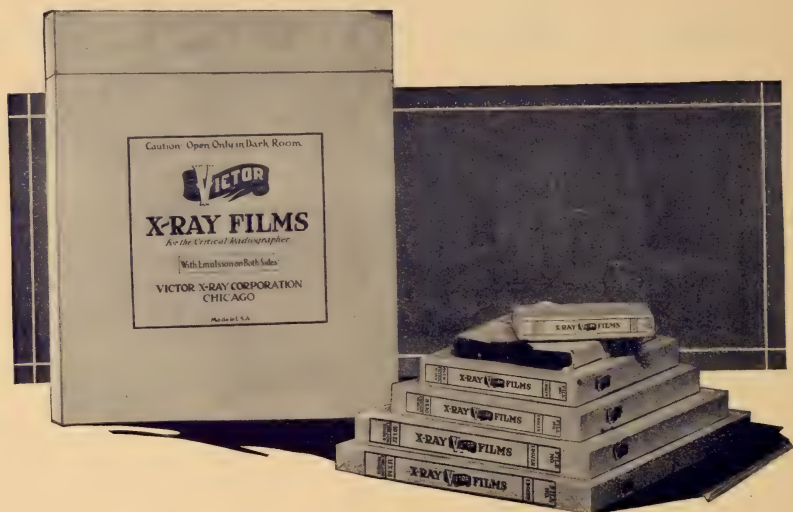
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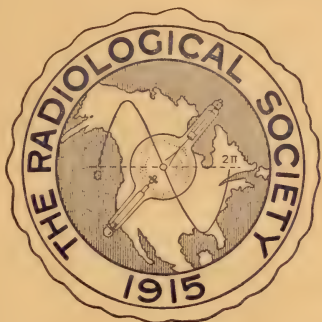


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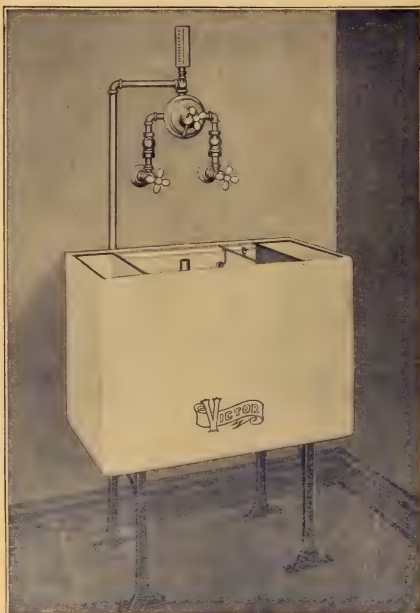
VOL. III

MAY, 1922

No. 5



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THE RADIOLOGICAL SOCIETY
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AT OMAHA, NEBRASKA



At Last— A Perfect Developing Tank

NO MORE need a bad smelling, leaking developing tank be tolerated in the dark-room.

Here is an all-metal, heavily white-enameled tank that will not crumble, therefore will not leak or absorb the chemicals. It is chemical proof. Guaranteed against chipping, checking or cracking.

30 to 45 minutes required to regulate temperature with stone tank—with this tank, 6 to 9 minutes.

A thermostatic valve keeps any desired temperature constant, circulating on all sides of the developing units suspended in the large tank. If either the hot or cold water supply fails, the thermostat automatically shuts off entire supply to the tank before temperature change can affect developing process materially. Rate of flow to tank can be regulated, as well as temperature.

Write for further particulars.

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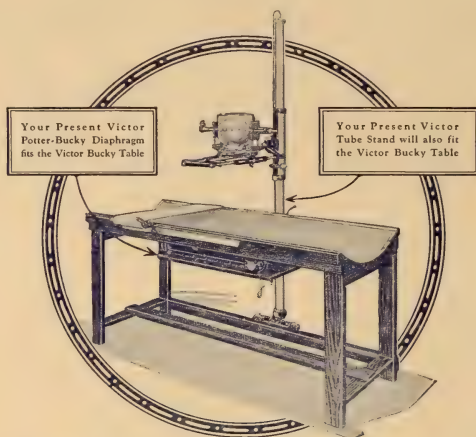
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JUNE, 1922

No. 6



PUBLISHED MONTHLY BY
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AT OMAHA, NEBRASKA



Victor Improvements Will Fit Your Present Victor Apparatus

THE research systematically conducted by the Victor X-Ray Corporation results in the development of many improvements. No physician wishes the science of Roentgenology, so dependent on apparatus, to stand still.

But what of the physician who has bought a complete Victor equipment, only to find, a few months later, that improvements have been made? Must he install an entirely new equipment in order to keep abreast of the times?

It has been the policy of the Victor X-Ray Corporation, wherever possible, to design apparatus and their accessories so that *improvements may be adapted to*

existing apparatus without the necessity of discarding an entire equipment. In a word, Victor apparatus is standardized. Take the Victor Bucky Table, for example. This table will readily accommodate the Victor Model Potter-Bucky Diaphragm; any Victor tube stand can also be attached in a few minutes. Thus, in instances where the X-Ray Laboratory already has the Victor Diaphragm and Tube Stand, the only expense involved is the table itself.

So, standardization of Victor apparatus makes it possible for the physician to take advantage of the latest developments of research without completely discarding his X-Ray equipment.

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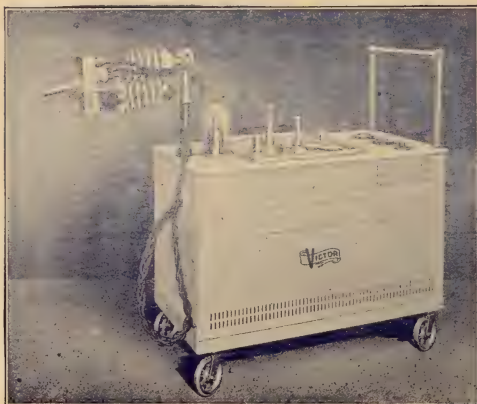
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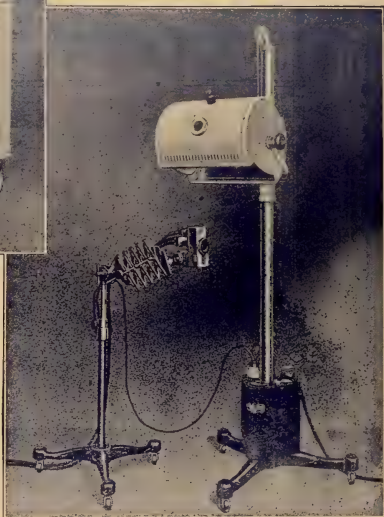
Hospital Unit

Your Actino-Therapy Equipment

is described interestingly and in every detail in a catalog which is now in the hands of the printers. A copy of the first issue will be reserved for you upon request.

This new catalog introduces Victor Ultra-Violet Lamps, the most recent addition to the Victor line of Electro-Medical apparatus. These lamps are the well-known Burdick Models, embodying advanced ideas in electrical and mechanical design and construction.

Actino-Therapy has created a wide interest in the medical sciences, and the increasing demand for equipment is an indication of recognition by the profession of its broad application and effectiveness. In your consideration of equipment, bear in mind that the same research and



Combination Air-Cooled and Water-Cooled Equipment

engineering facilities responsible for Victor X-Ray apparatus are available for maintaining an equally high standard for Victor Ultra-Violet Lamps.

Another important factor—*Victor Service*, through our Branch Sales and Service Stations located in the principal cities. This trained field organization assures you permanent satisfaction in a Victor outfit.

WRITE FOR PARTICULARS

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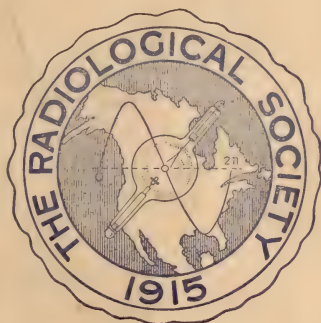


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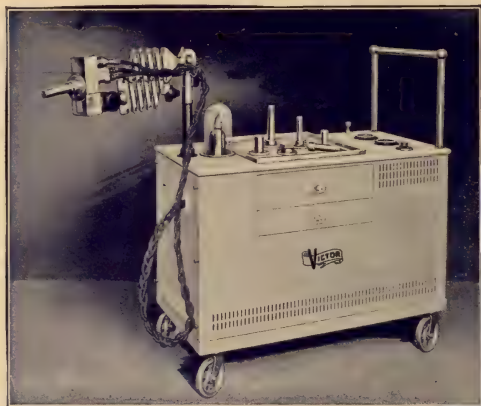
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OF NORTH AMERICA
AT OMAHA, NEBRASKA



Hospital Unit

Your Actino-Therapy Equipment

is described interestingly and in every detail in Victor Quartz Lamp Bulletin No. 253 just off the press. Your copy, together with several important reprints, will be mailed on request.

This new catalog introduces Victor Ultra-Violet Lamps, the most recent addition to the Victor line of Electro-Medical apparatus. These lamps are the well-known Burdick Models, embodying advanced ideas in electrical and mechanical design and construction.

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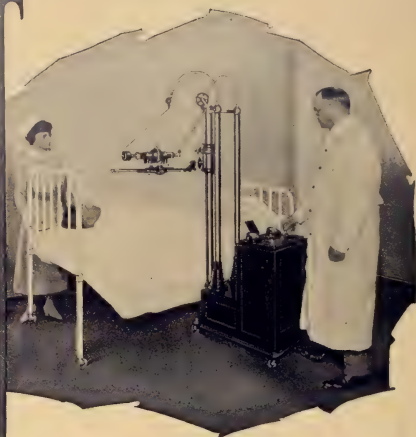
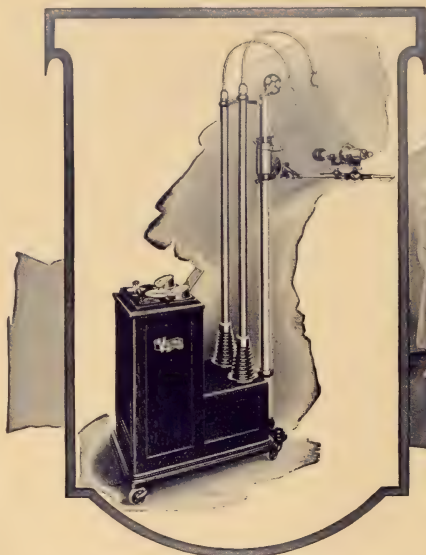
VOL. III

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This New Victor X-Ray Outfit Is Radically Different It Is a Stabilized Mobile Unit

What the Stabilizer Does

When the voltage of the line supply current fluctuates (this condition prevails on practically every line) the Victor-Kearsley Stabilizer, incorporated in this unit, acts *automatically* to hold the milliamperage constant in the Coolidge Tube—the exact milliamperage desired for the radiograph. 100% radiographic results are therefore insured—no “retakes” necessary because of fluctuating line supply.

Control Features

Auto-transformer allows selection of any penetration desired from 3 to 5 inches, divided into 26 steps—a fineness of graduation that is distinctive in this outfit. The stabilizer permits selection of any milliamperage from 2 to 30, at any setting of the auto-transformer. A chart on the control board helps the operator to obtain instantly any current value.

The Victor-Kearsley Stabilizer is one of the most important X-Ray developments since the advent of the Coolidge Tube itself. It should not be confused with other devices which tend to stabilize only the current to the filament of the tube. The important advantages of this unit are fully explained in a special bulletin, which we will gladly send you on request.

Circuit Breaker Safety Device

In case of “overload” beyond the capacity of the tube (30 Ma. at 5” back-up spark) this device *automatically* shuts off current supply, preventing damage to tube and apparatus. Consider also the importance of this from the standpoint of protection to both operator and patient, in case of accidental contact with the high tension system.

A Complete X-Ray Unit

Where only limited space is available in the physician's office, the compactness of the Victor Stabilized Mobile X-Ray Unit solves the problem. Mounted on casters and easily moved about, it lends itself to varied demands. It also becomes an extremely valuable addition to any existing hospital equipment.

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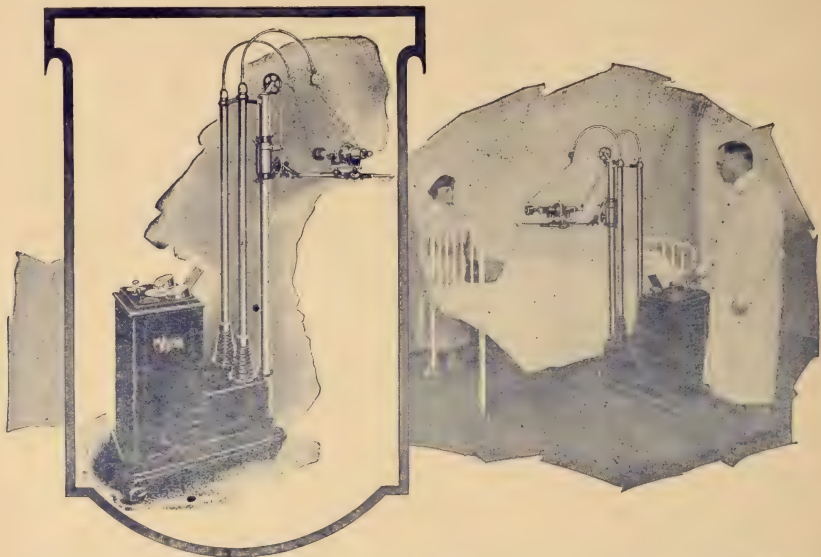
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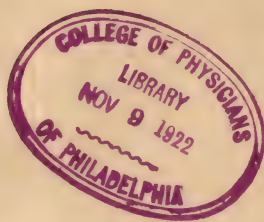


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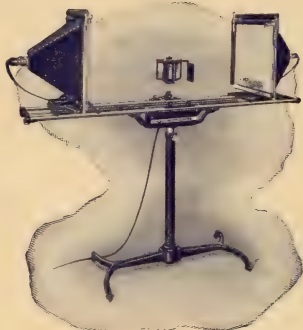
NOVEMBER, 1922

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AT OMAHA, NEBRASKA

STEREOVISION vs. ILLUSION



Victor "Truvision" Stereoscope

Note the well balanced design, solidity in construction and pleasing appearance of this apparatus.

The entire mechanism, including rheostat, can be raised from sitting height to standing height, through an ingenious device in the vertical column which raises or lowers the mechanism to suit individual convenience.

Here Is Economy

Only two lamps are used in this outfit, as against eight in the ordinary stereoscope. On the basis of one hour's use per day for 300 days each year, these two 150 watt lamps consume 90 Kilowatt hours of current; the average cost being 10¢ per KW. hour makes a total yearly cost of \$9.00. The usual 18-lamp stereoscope uses 800 watts per hour or 240 KW. hours, at an annual cost of \$24.00 or an additional expense of \$15.00, not to mention the difference in cost for lamp renewals.



A SCIENTIFIC analysis of the principles of stereovision and a retrospect of its application in X-Ray diagnosis reveals the fact that the roentgenologist has not been realizing true stereovision—even with the best stereoscopes at his command.

The most important single item contributing to stereoscopy is that of illumination, which involves a proper knowledge of:

- (a) the correct intensity of illuminant
- (b) the correct distribution of illuminant

Experiments have proved that some of the most brilliant effects obtained with stereoscopes now in general use are in truth only illusions which defeat the very purpose of stereoscopic vision, namely, the accurate evaluation of distance perception whereby the observed depths represent accurately the relations of the anatomic parts under study.

The new Victor Stereoscope is an essential departure from the principles heretofore unchallenged. The source of illumination is one light bulb (as compared with four in previous models), i. e., one only in each illuminating box.

With this central source of illumination the light is distributed over the radiograph in the same proportions as the X-Radiation which produced the radiograph—the greater intensity being in the center, which according to correct technique is the position of the anatomical part under immediate observation. This method of light distribution obviates artificial effort to enhance the stereoscopic effect, which effort, through over-illumination, leads only to illusion.


With a finely graduated rheostat control to regulate the light intensity in both boxes simultaneously, this apparatus is the nearest approach to the ideal for accurate stereoroentgen diagnosis.

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VOL. III

DECEMBER, 1922  No. 12



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AT OMAHA, NEBRASKA



Two Models of Victor Deep Therapy Apparatus Now Available

280,000 Volts
Capacity
"Original Model"

200,000 Volts
Capacity
"Snook Special"

The Victor Deep Therapy Apparatus, announced over a year ago, is still the selection of roentgenologists who are looking forward to future developments of the Coolidge Tube, whereby voltages considerably higher than 200,000 can be used.

In view of the fact that not a few roentgenologists and hospitals are content to confine their therapy work to within 200,000 volts, and therefore do not require the reserve energy provided in the original Victor apparatus, a new and intermediate model, the "Snook Special," has been designed, having a voltage rating of 200,000, to provide for all deep therapy technique up to the present.

This intermediate machine can be obtained either as a straight therapy machine or as a combination diagnostic and therapeutic machine, in both instances with a maximum voltage rating of 200,000 peak volts. The transformer has a current (milliamperage) capacity considerably in excess of that required for the present deep therapy tube.

The fact that this outfit can be furnished also as a combination for both therapy and radiography, answers the requirements of many laboratories.

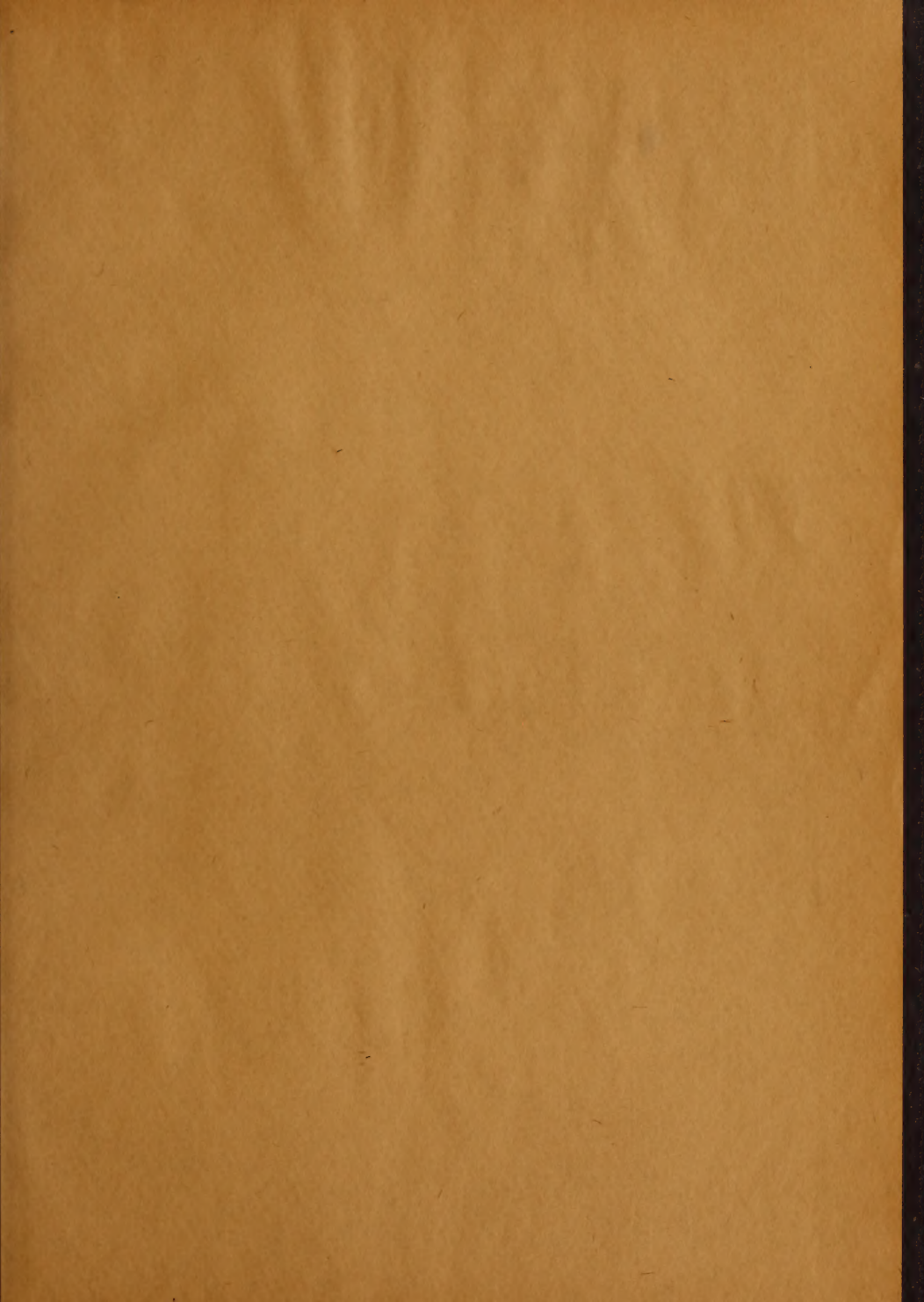
The principles of the renowned "Snook" cross-arm type rectifier have been utilized in this new model, and even improved upon in the details of the essentials, making it far superior to any "Snook" type rectifier we have ever put out, notwithstanding the recognized superiority in its present day form, as exemplified in our standard "Snook" machine.

Deliveries are scheduled to begin in January. Descriptive literature is in preparation—write us to keep you posted with detailed information on this important development.

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